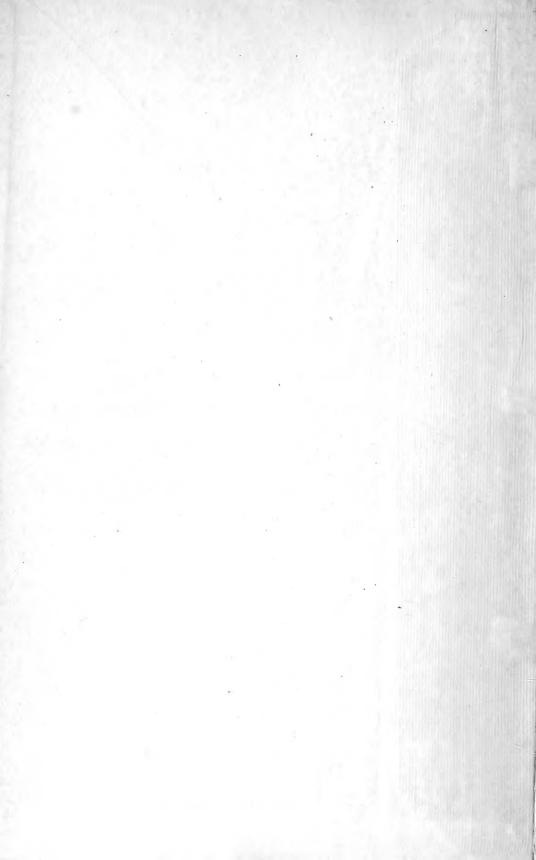
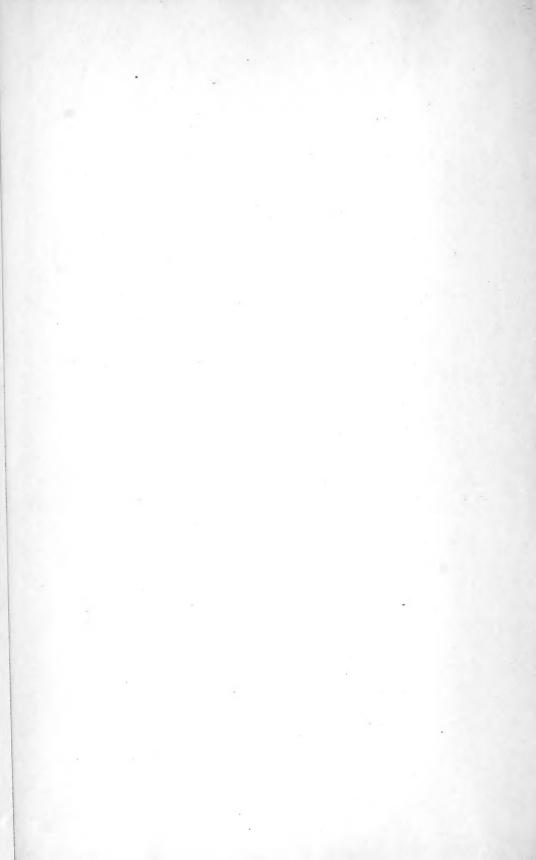
Guide to California Insects.

WOODWORTH

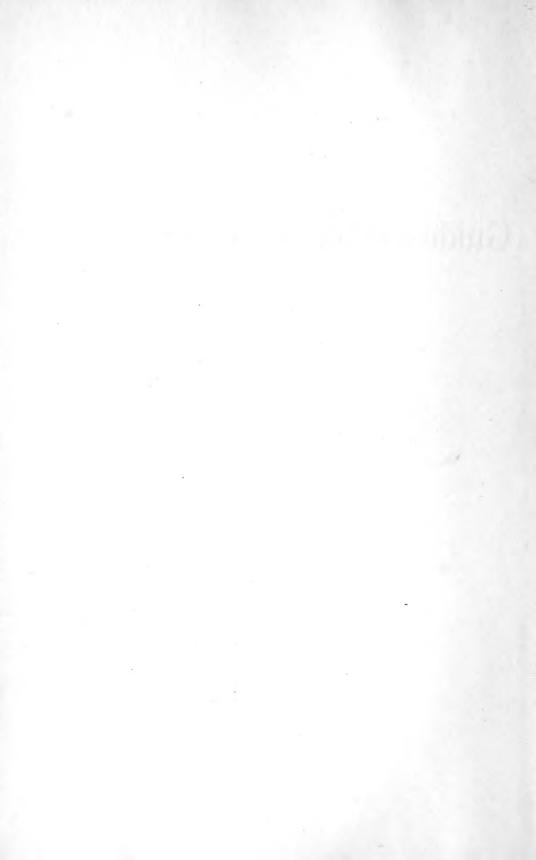






GUIDE TO CALIFORNIA INSECTS

WOODWORTH



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Guide to California Insects.

C. W. WOODWORTH.
Professor of Entomology, University of California.

FIRST SEMESTER.

THE LAW PRESS BERKELEY

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PREFACE.

Students in entomology need an outline of the species inhabiting the region in order that they may comprehend the relationship that the special forms under consideration in the various courses bears to the whole assemblage of insects. This is the more necessary since insects affect human interests in such a variety of ways, requiring that they be studied from diverse and narrowing view points.

Those beginning the study of the subject are advised to familiarize themselves with the illustrations as the first step in gaining the desired general concept. These figures are all of local forms drawn or photographed by the author or made under his immediate direction and have been loaned for use in this publication by the Experiment Station thru the kindness of the Director.

Attention is particularly directed under each family to all the more important insects both of the local fauna and of other countries.

Synopses are presented for the identification of all the family groups and eften for genera and species when of economic importance.

The synopses are arranged in an original form which the author has employed in his classes for a number of years and found to facilitate the identification of insects and to emphasize the dominant groups and their distinctive characteristics.

The plan of these synopses is to give in the order of size, the names of the leading groups, each followed by the characters distinguishing it from all that follow in the table. When the character is held in common by a larger group and by one or more smaller groups the latter are given in the same paragraph each followed by its distinguishing peculiarity.

In using the tables therefore always begin with the first group and determine whether the character applies to the insect in question, and if not, proceed to the next paragraph, wholly disregarding the characters of the smaller groups not heading a paragraph until the leading character aplies and then each of the characters of the smaller groups in that paragraph must be examined.

All structures referred to in the synopses will be found explained in the general discussion of the order or family or when of general applicability in the introductory chapter and other technical terms used in discriptions are given in the appendix.

The names applied to insects have been exceedingly unstable and give a great deal of trouble even to experienced entomologists. Under each family will be found an alphabetical list of all the names that have been applied to california insects with citations to the present accepted nomenclature.

The appendix includes many directions which will be of use both in the laboratory and in the field.

Finally such a guide as this should be kept up to date. To accomplish this the whole book is held in type so that it may be revised for each semister.

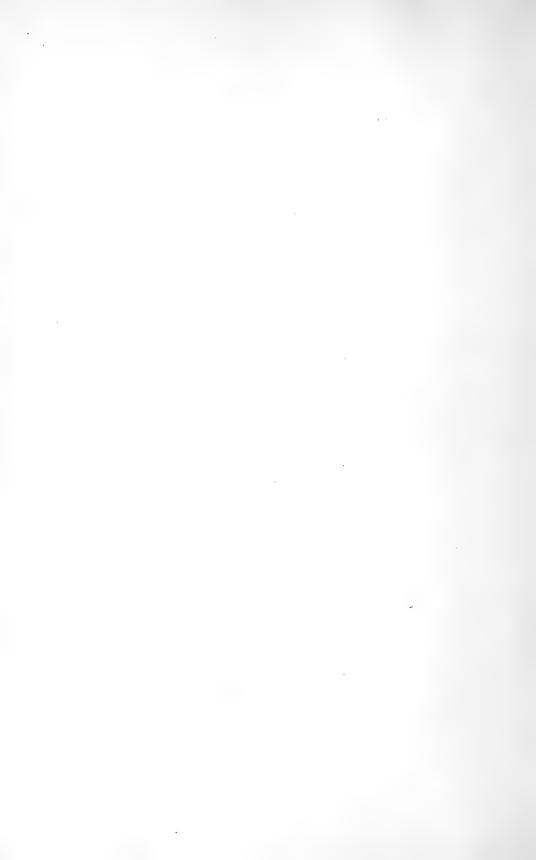
The author will appreciate very much to have the mistakes or omissions of this book brought to his attention inorder that they may be rectified in the next edition. He wishes to acknowledge the help he has already received from members of his staff, particularly Dr. Van Dyke in Coleoptera, Prof. Herms with the parasitic forms of all orders, Mr. Bridwell in the Hymenoptera and Mr. Coleman in the Coccidæ. The Thysanoptera have been revised for this book by Mr. Jones.

C.W.Woodworth.

Berkeley California. August 1913.

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INTRODUCTION.

Insects equal in numbers of species all other living beings, both animals and plants, but systematically they constitute only one of the classes of one of the phyla into which animals are divided.

PHYLA OF THE ANIMAL KINGDOM.

Arthropoda: with jointed legs operated by muscles attached directly to the skin or when legless with air tubes or tracheæ in every part of the body.

Chordata: with back bone or in certain aquatic members only a soft notochord between central nervous system and body cavity.

Mollusca: with a shell, or where this is wanting, with a well developed eye. (if shell is composed of a small and a large valve, the latter perforated, it is a Molluscoidea.)

Echinodermata: body radially arranged. Cœlenterata: with a common gastrovascular cavity.

Protozoa: unicellular.

Annulata. Porifera: many openings into digestive tract. Platyhelminthes: without anal opening, or with whole surface ciliate. Molluscoidea: ends of digestive tract near together Trochelminthes: with retractile anterior ring of ciliæ. Nemathelminthes: body unsegmented and mouth region not retractile.

Insects are by far the most important group of animals in their effects on human interests, excepting only the vertebrates in which man himself belongs. Entomologists have rendered such signal service in studying and controlling useful and harmful insects that they have generally been called upon to extend their endeavors outside of the class insecta, and to consider all similar matters in other classes or even in other phyla.

The problems in the other phyla are: for Chordata, the poisons used for killing rodents and birds, which are commonly classed with insecticides in Mollusca, the treatment of snails and slugs attacking plants corresponding with the treatment of insects doing similar injury, and among the annulata and other worms numerous parasitic forms both on plants and animals

which cannot well be separated from insect parasites.

CLASSES OF ARTHROPODA.

Insecta: winged, or one pair of antennæ and three pairs of legs, or if legless, with tracheæ.

Arachnida: without antennæ.

Crustacea: with two pairs of antennæ.

Myriapoda. Onychophora: legs not definitely jointed.

The plant feeding forms of all these classes are always treated by economic entomologists as the they were insects, the most important group being the red spiders among the arachnida; of lesser importance are the sow bugs among Crustacea, and the millipeds of the Myriopoda.

The Structure of Insects is identical in its general features with that of the other classes of Articulata. The exterior of the body is hardened to give attachment to the muscles and serves as the skeleton as well as skin. The hard parts are the secretion of a delicate layer of cells called the hypodermis, which develops originally in the egg as a flat disc from which most of the organs of the body, internal as well as external, arise.

This disc is called the ventral plate because it is converted directly into the breast of the insect, cells around the edge multiplying and giving rise to the remaining parts of the body.

The first differentiation of the ventral plate is the splitting off from the inner side of two ribbons of cells which become the nervous system, lying as a double chord along the middle line beneath. These produce long slender filiments, the nerves, which grow out to every muscle and sense organ as they are developed. The cells from which these proceed gather themselves into a regular series of knots which early unite in pairs forming ganglia along the double ventral chord.

The ventral plate becomes at the same time marked off into a series of areas, one corresponding with each ganglion. As the ventral plate grows and finally closes over the back, these areas form rings or segments of the body. The cells between these areas not only become somewhat different in appearance but finally secrete a more delicate and flexible cuticle than those forming the general surface of the segment. These thin portions of the skin permit the body to bend between the segments.

Long before the segments are completed and even before the two halves of the ganglia have come together there begins an outgrowth opposite each forming ganglionic mass, showing first as slight elevations of the surface but becoming long and tubular. Soon differentiations of the cells of these processes similar to those which produce the segments, result in the production of jointed appendages as indicated by the name Arthropoda.

In the appendages which become the legs the first articulation to become evident is the knee joint. The adjacent segments are named after human anatomy, femur and tibia.

The parts of the knee joint are:-

- 1. The hinge consisting of a region on both sides where hardened processes from femur and tibia meet. The soft skin being very narrow at these points and folds inwardly out of the way. In the more complex knee joints like that of the grasshopper the hard parts also fold in making long hinges.
- 2. The guide pieces of the femur, a flat lobe on either side at the tip below the hinge and overlaying the base of the tibia when the knee is flexed.
- 3. The collar at the base of the tibia beginning as a crease extending over the back of the tibia from hinge to hinge and widening out in the middle like the visor of a cap.
- 4. The tendons, long slender infoldings of the soft skin both above and below, at the end of the tibia serving respectively the extensor and flexor muscles. These tendons usually reach almost the whole length of the femur.

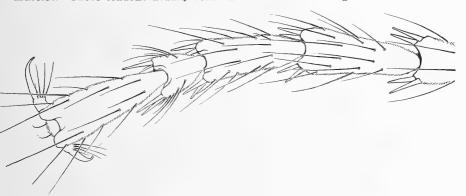


Figure 1. Foot of an ant.

5. The knee caps usually present as two hardened plates above between the ends of the femur and tibia.

Almost as soon as the knee can be made out, the structures of the foot or tarsus begin to show. In most legs there are five tarsal joints, the fifth bearing on the tip a pair of claws (ungues), between which there are a pair of pulvilli, or more commonly a single empodium, or both.

When the basal joint is enlarged it is commonly called the metatarsus.

On the end of the tibia next to the foot there are usually one or more spurs.

At the base of the leg there normally develops at least two articulations allowing motion in two directions and separating off the coxa. Between this and the femur there may be an additional segment or two, the trochanter.

Before the legs there are four pairs of appendages exactly similar at first to the rudimentary legs but each soon takes on a different shape, varying also according to the group. These appendages arise from four primitive segments of the head and are:—

1. Antennæ, usually long and many jointed. When the basal joint is long

it is called the scape. The next joint (pedicel) is usually separated from the remaining joints (flagellum) by a hinge.

- 2. Mandible, typically in the form of a somewhat curved cone, ending in a point or with a number of teeth. The two outer angles of the base bear the articular condyles and the soft skin of the basal articulation infolds at the inner angle into a large tendon reaching nearly to the back or top of the head.
- 3. Maxillæ, appendages with very complicated and varying structure. Typically consisting of two large segments (cardo and stipes) hinged together and perhaps corresponding to the femur and tibia respectively, the latter bearing the palpi corresponding to the foot but with structure more like an antenna, and the lobes called galea and lacinia, the latter within and usually sharp pointed or toothed. The stipes is often so divided as to have a subgalea from which the lobes arise and a palpifer bearing the palpus.
- 4. Labium, almost identical in structure with the maxillæ but usually grown together forming a lower lip, and often with a less number of distinguishable parts. The terms mentum and submentum are commonly used instead of stipes and cardo and these terms are not used with uniformity in the different orders.

Besides the four segments represented by the appendages, from one to four additional segments have been considered by different authors as occurring in the primitive head, the best marked of which is the preantennal and the least evident the prelabial.

After the appendages begin to develop as evaginations of the ventral plate there begins an invagination at a point on the middle line at about the suture between the mandibular and maxillary segments. This passes between the commissures of the nervous system, dividing the ganglia of the head into two sets which soon unite into two compound ganglia known because of their position relative to this invagination as the supra- and suboesophageal ganglia.

At a later period a similar ingrowth from the hind end of the ventral plate produces the intestines and just before the closing in of the back of the embryo a third portion of the digestive tract is formed as a single layer of cells which envelop the remains of the yolk and finally becomes the stomach. Usually not until after the insect begins to feed are the walls broken down between these three regions making the alimentary canal continuous thru the body.

Around the digestive tract a system of muscles are developed which by constricting the tract from before backward forces the food along the canal. Irregularity in the arrangement of these muscles and corresponding differentiations of the cellular layer results in the division of the digestive tract into a series of organs as follows:—

Stomodæum.

1. Pharynx or mouth cavity, often partly closed by the thickening of the

wall, if above, the epipharynx; below, the hypopharynx. Into the mouth cavity open a series of glands of varying function but all called salivary glands. Among these are the silk glands found in a great many groups of insects. All of these glands and their ducts are produced as invaginations of the wall of the pharynx.

- 2. Œsophagus, a slender tube thru which the food passes rapidly. In caterpillars it is rather short but in many insects it reaches fully half the length of the body.
- 3. Crop or proventriculus, which receives and often holds the food for a considerable time practically unchanged. In bees this organ is the honey sac. In many insects there are large glandular pouches called cœca opening into this cavity.
- 4. Stomach valve, which provides for the intermittent passing of the food from the crop to the stomach. Often this region is called the gizzard when it is large and provided with a thick muscle layer. The interior cuticle may at the same time be hardened into a very elaborate system of teeth.

Mesentron.

5. Stomach, usually the largest portion of the digestive tract. The cells of the stomach wall are large and gland-like; there are no glands opening into this region, and no interior cuticular lining such as is found in all other parts of the digestive tract.

Proctodæum.

- 6. Ileum or large intestine, often appears as part of the stomach, the line of separation however can always be made out by the attachment of the malpighian tubes, which are long slender glands serving as excretory organs.
- 7. Colon or small intestine, furnished with muscles somewhat like those of the œsophagus, passing the contents along rapidly; and in consequence this region is usually found empty.
- 8. Rectum, commonly marked out by the thick overlaying rectal glands and is often highly muscular with the interior wall thickened in ridges resembling somewhat the gizzard and which serves as a filter pump to extract the liquid portion of the contents before passing the solid portion out.

The most elaborate system of internal organs are the tracheæ or air tubes. They are called tracheæ because of a general resemblance in function and structure to the wind pipe in human anatomy. There are no organs in the body of an insect comparable to the lungs, the tracheæ taking the air directly to every part of the body. In aquatic insects the original openings may finally close, and the exchange of oxygen and carbonic acid with the surrounding water is made thru tracheal gills.

Tracheæ develop as invaginations of the body wall in quite a late stage

in the development of the embryo, a few cases being known in which they are not developed so as to be functional at hatching. The invaginations are formed on either side of the segment. Some of the segments always fail to produce tracheæ and in such cases the tracheæ of adjacent segments supply the lack. The parts of the tracheal system are as follows:—

- 1. Spiracles or stomata, at the point of invagination there usually develops an elaborate structure bordered by one or more chitinous rings, within which dense combs of spines stand guard over the slit-like opening. Within the body the trachea may expand into a subspherical chamber and may be provided with chitinous bars with muscle connections enabling the insect to completely close the opening.
- 2. Spiracular trunks, being the portion of the tracheal system developed before the proximity of the digestive tract resulted in the stopping of the growth at the tips of the invaginations and the beginning of growth at two points like adventitious buds for the production of the lateral trunks.
- 3. Lateral trunks, resulting from the joining of the whole series of outgrowths on a side into one long tube extending almost from end to end of body. The points of union are at first closed just as are those of the three regions of the digestive tract and there always remains at these points a ring of entirely different structure from the surface of the tracheal wall.
- 4. Dorsal and ventral girdles, developing at various points along the lateral trunks, and varying greatly in number and position in different insects. These arise as pairs of large tracheal trunks growing around the digestive tract, meeting and joining in the same way that the elements of the lateral trunks grew together.
- 5. Branches, which arise at various places along any of the trunks, but chiefly at or near the point where the first forking occurred which subdivide into a great number of very fine thread-like tubes which proceed to invade every tissue and organ and show no tendency to anastomose.

There are in addition to the digestive tract and tracheæ numerous glands opening thru the skin in various parts of the body in different insects, which arise as invaginations of the skin, usually rather late in the development of the insect. The ducts of the sexual organs also belong to this category. There is first produced a pair of invaginations which are finally pinched off entirely from the skin and finally attach themselves to the end of a single median ingrowth. The first egg therefore passing out from the ovary must first break thru its own investment of connective tissue and into one of the lateral ducts and then thru the walls separating this from the common duct. A special organ to tear the way thru these tissues is developed below the lowest egg in an ovariole.

The sense organs of insects consist of:-

1. Eyes located on the head, usually a pair of compound eyes and three simple eyes.

- 2. Ears in the form of tympanal organs, found only in a comparatively small number of insects, on the base of the abdomen in grasshoppers and on the base of the front tibiæ in katydids and crickets.
- 3. Modified hairs with a great variety of functions which may be grouped into two classes, (a.) long hairs chiefly serving as organs of touch, certain of them vibrating with definite tones are believed to be organs of hearing.
- (b.) very much shortened hairs, often almost completely suppressed, retaining and specializing however, the basal structures. These respond to chemical stimuli and may be roughly classed into organs of taste and smell, according as they respond to the contact of liquids or gasses. Many different kinds of these modified sense hairs or pits may occur on the same insect indicating perhaps the possession of senses unknown to us.

Besides the cells which took part in forming the ventral plate there were other cells in the embryo which remained in the yolk or only attached themselves to the inner surface of the ventral plate. From these the bloodcells, connective tissue, fat bodies and muscles arise. The blood cells correspond with the white blood corpuscles, nothing existing in insects comparable with red blood cells. Connective tissue forms a thin investment over all the organs. When invaded by a nerve it develops into a muscle, and when storing an inordinate amount of food material it is a fat body.

Since the skeleton of an insect is external it is necessary to cast off the skin from time to time to provide for the increasing size. This molting process is quite complicated. The following steps may be recognized:—

Preliminary.

- 1. Storing food to repletion.
- 2. Growth of skin epithelium, increase in both number and size of cells.
- 3. Emptying of digestive tract.

Somnus.

- 4. Detachment of epithelium and muscles from cuticle thru the secretion of a fluid as in a blister involving the withdrawal of the contents of the harder parts, (claws, head of caterpillars, etc.)
 - 5. Completion of epithelium over ends of muscles.
- 6. Secretion of expansion layer which becomes much wrinkled thus providing for enlargement of skin surface.
- 7. Deposition of new cuticle against expansion layer, largely exhausting the epithelial cells.
- 8. Regaining of muscle attachment to skin.

Molt.

- 9. Muscle action pulling legs and abdominal parts into thorax.
- 10. Bursting of old cuticle from internal pressure, along back of thorax.
- 11. Emergence of the insect.

Concluding processes.

- 12. Completion of expansion of wrinkled parts by blood pressure produced by filling the air sacs and by the contraction of the muscles of the body wall.
- 13. Hardening of cuticle on exposure to the air.
- 14. Reginning of feeding.
- 15. Completion of oxidization of skin pigment.

Metamorphosis is the term used to express the changes an insect undergoes from the time it hatches from the egg until it assumes the adult condition.

In the more primitive insect it is not very striking. In those that possess

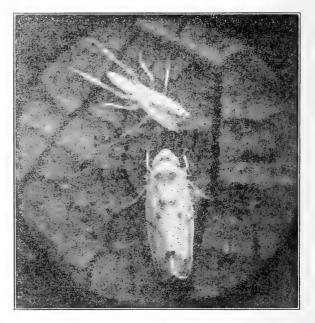


Figure 2. Photograph of a vine hopper just molted, and of the skin from which it came.

wings the change on becoming adult is very much more evident. The somnus just preceding the last molt is longer and the whole thoracic structure is reorganized to provide the hinge and musculation necessary for flight. When the change to the adult becomes so profound as to extend the somnus over the ertire instar preceding the acquirement of adult structures we have a third type of metamorphosis. This inactive and nonfeeding stage, the pupa, usually becomes very different externally from the larva. The development of complex metamorphosis permits a simultaneous improvement in the adaptation of both the young and the adult insect. Insects having this kind of metamorphosis greatly outnumber all others.

Hypermetamorphosis arises in a similar way among certain beetles for the better adaptation of the very young and the older larval stages.

The wings of insects are of necessity limited to the last stage because provision for molting cannot be made in an organ delicate enough to serve for flight. Wings are so complicated and so useless for this function until they are large organs with hinge and muscles that they must have arisen as an organ for another purpose. Aquatic insects often possess gills somewhat similar to wings in structure, and such organs are generally considered as the precursor of the wings. An intermediate stage between the gill and the wing is presented in the wing-like gill covers of certain May-fly nymphs. The most important structures in the wing are the strenghening ribs called veins. The following elements of a venation can be distinguished:—

1. Marginal veins, always present on both edges at the extreme base, sometimes extending all around the wing. The anterior marginal connects

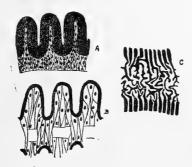


Figure 3. Section of a wing showing the folding of the cuticle just before the final mo.t. A. section of vein. B. of membrane C. tangentiar section showing the wrinkling of the membrane in both directions.

with the tendon which pulls the wing from the rest position, the posterior is continuous with the hind edge of the segment.

- 2. The primary vein, extending across the wing in front of the middle and at base bearing the lower articular condyle. This vein is also invariably present in functional wings.
- 3. The anterior and posterior veins, variable in number, usually one anterior and two or three posterior.
- 4. The independent veins and branches, occupying the spaces in the outer portion of the wing between the veins previously mentioned. They probably all arose as independent veins tho many became attached as branches.
 - 5. Cross-veins, probably developing spontaneously over the wing surface
- A theory of venation very largely accepted, derives the veins directly from the tracheæ of the gill and bases a nomenclature upon a theoretical primitive number and arrangement of these structures. As first presented there were supposed to be eleven of these veins but all the even numbers were

Imago.

Insect.

Nymph.

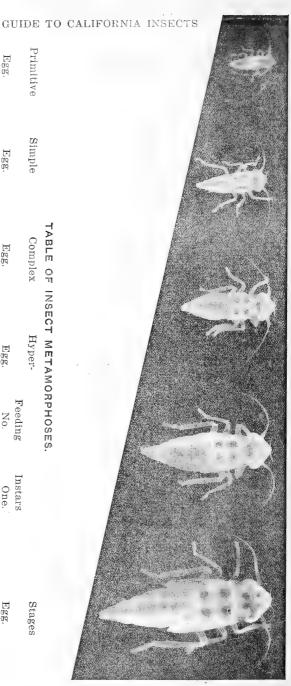


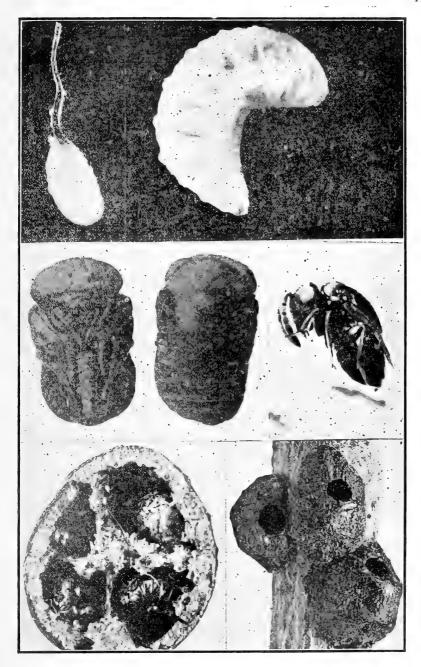
TABLE OF INSECT METAMORPHOSES. Complex Hyper-

Primitive

Simple

Egg.

Complex Egg. Larva.	Hyper- Egg. 1st. larva. Pseudo-pupa 2nd. larva.	Feeding No. Yes. Yes. Yes.	Instars One. One or more One. Several. One or more.	
		Yes.	One. One. One.	Ō
	2nd. larva.	Yes.	One or m	ore.
	Pupa.	No. Yes.	One. Several.	
	Imago.	Y_{es}	One.	



and remaining numerous in the older groups of insects but in the more modern orders only a few of these are left, tho remaining a very important element of the venation.

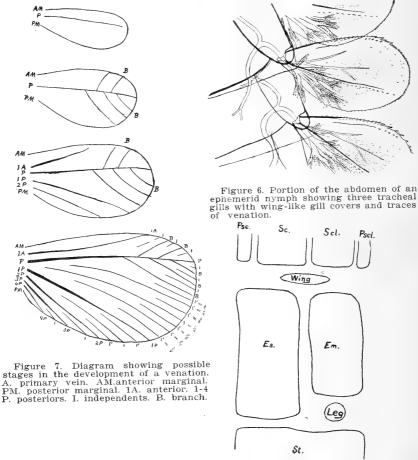


Figure 8. Diagram of thoracic structure. Psc. præscutum. Sc. scutum. Scl. scutellum. Pscl postscutellum. Es. episternum. Em. epimeron. St. sternum.

Figure 5. (Opposite page.) Complex metamorphosis, the development of Scutellista cyanea, a parasite of the black scale. Beginning to the left above, the figure shows egg, larva, pupa (back and side views), imago black scale overturned showing four larvæ, and two black scales showing exit holes made by the parasite.

soon dropped out leaving six, and names substituted for the numbers as follows:— I. subcostal, III. radius, V. media, VII. cubitus, IX. and XI. anal veins. Three of these were supposed to be simple, III. five-branched V. four or three-branched, and VII. two branched. The radius is the primary vein, the media and all the branches independents. Cross-veins have no place in the system.

There are a number of distinct systems of nomenclature used in the different orders as will be explained as each group is considered.

The thorax consists of three segments known as the pro- meso- and meta-thorax and these prefixes apply also to all the parts of which each segment is composed. The parts of a segment are: a single piece beneath—the sternum; two on either side— episternum in front and epimeron behind; and four sclerites on the back— the præscutum, scutum, scutellum and postscutellum. The theory has been suggested that they represent vestiges of four primitive segments, but it seems more likely that the development of legs and wings has caused the differentiation from a simple segment. The sutures seem to be in the nature of infoldings to give greater strength where the insertion of the leg weakened the segment and where the pull of the leg muscles needed greater resistance.

The legs may thus be held responsible for the cutting off of the sternum and the dividing of the upper portion into an anterior and a posterior portion. The development of the wing results in a more complete cutting off of the dorsal portion of the segment. The præscutum and postscutellum may be chitinizations of the intersegmental membrane to give attachment and resistance to the great muscle of flight.

The great longitudinal wing muscle which causes the down stroke of the wing by arching up the back connects the anterior ends of segments; thus the hind wing muscle reaches from the metathorax to the first abdominal segment. Where there is a great constriction at the base of the abdomen it is necessarily between the first and second segment. The first abdominal segment is therefore often counted as one of the thoracic segments.

Very early in the history of winged insects provision was made for doubling the wing back against the body when not in use. The Odonata and Ephemerida are the only existing groups in which the wings are rigidly attached to the wing roots. In all other cases we can notice:—

- 1. The articulation of the base of the anterior marginal, and the development of a tendon for direct muscular attachment.
- 2. The basal interruption of all veins except the posterior marginal and the primary or their fusion with the base of the primary.
- 3. The formation of at least one folding area involving all the base of the wing back of the primary, including the posterior marginal vein.

Associated with the complication of the base of the wing there is an entirely new plan of musculation. In the Odonata the tendon of the elevator muscle

is attached to the inner end of the wing root and extends toward the breast. The down stroke of the wing results from the contraction of muscles attached to the side below the wing hinge which simply pull the sides in, forcing the blood against the back and wing roots elevating them and so depressing the wing.

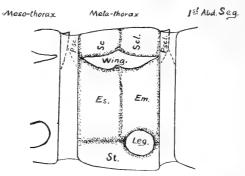


Figure 9. Diagram of thoracic structure dotted lines showing infoldings for stiffening the segment. Letters as shown in figure 8.

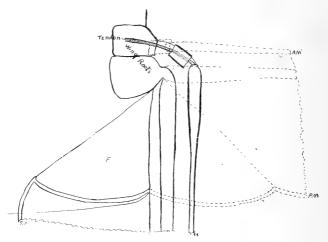


Figure 10. Diagram of wing fold. F. fold area.

In the great majority of insects on the contrary the middle of the back is bent up by the pull of muscles extending lengthwise and the up stroke by muscles reaching from back to breast.

The full name of an insect consists of:-

1. Genus name, usually a Greek substantive and always beginning with a

capital letter.

- 2. Species name, usually a Latin adjective agreeing in gender with the genus name and never written with a capital except when derived from a proper name and usually not even then.
- 3. Authority, the name of the first describer of the species, usually abbreviated and inclosed in parentheses if the species was not originally placed in the proper genus.

When varieties or subspecies are indicated, the name is formed precisely like the species name and given immediately after it followed by the authority of the variety and not that of the species. Sometimes the variety is considered subordinate to subspecies, and then the varietal name stands

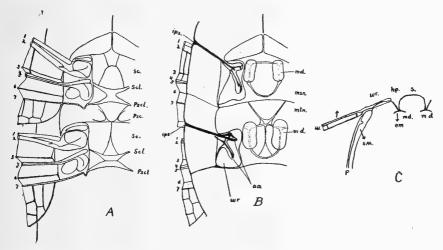


Figure 11. Wing attachment in Æschna. A. dorsal view. B. view from within. C. section. Letters as in figure 8. aa. articular condyle. w. wing. wr. wing root. awr. anterior wing root. pwr. posterior wing root. md. muscle disk. msn. mesonotum. mtn. metanotum. hp. hinge fold. em elevator muscle. dm. depressor muscle.

fourth and the authority fifth.

Groups higher than species are often called subgenera. Such names are formed precisely like generic names and given in parentheses between the genus and species name.

Names of groups higher than genus never appear as part of the name of a species and are almost uniformly derived from genus names by the substitution of a termination as -idæ for family and -inæ for subfamily -oidea has served for superfamily, tho the shorter -ina is to be preferred.

Order names are not derived from generic names, the most of them have the common ending ptera.

The primary classification of insects into orders was originally based on the wings, beginning with the horny winged beetles and ending with the wingless forms. Next the method of taking food was made the basis of separation into two great groups, the biting and the sucking insects. This has of late been largely replaced by a division based on the development those with primitive and simple metamorphosis in one series and those with complex and hypermetamorphosis in the other. None of these plans seem wholly satisfactory; that adopted in this book is chronological, that is the orders are given in the sequence of their appearence on earth as shown by the geological record.

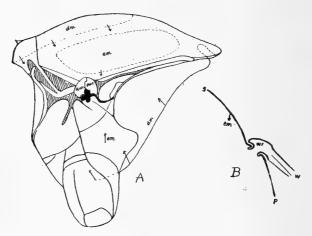


Figure 12. Wing attachment in Cicada. Letters the same as Figure 10.

The table following gives the original Linnæan system and that given in five recent textbooks. Folsom alone separates the Collembola from the Aptera and Comstock alone the Euplexoptera from the Orthoptera. Both Comstock and Kellogg separate the Mallophaga and Isopoda from the Corrodentia, and Comstock and Folsom the Siphonaptera from the Diptera. The author differs from the majority regarding Thysanoptera the all agree as to its location in the series. He differs from all five by placing the Neuroptera and allied forms with the Plecoptera, agreeing rather with most of those who have specially studied these groups in the belief that they are very closely allied despite the difference in metamorphosis. If these groups were made distinct orders, the historical arrangement would place Neuroptera just below Coleoptera, the Mecoptera below Diptera and Trichoptera antedating Hymenoptera and Lepidoptera.

The placing of Ephemerida lowest of the winged insects by Comstock

and Kellogg is based on the theory that many veined wings antedated those with few veins and corresponds with the idea of eleven primitive veins.

The placing of Orthoptera lowest by Folsom and Sanderson follows those who do not think that wings arose as tracheal gills or in aquatic insects.

The arrangement of the four largest and most recent groups, Coleoptera, Diptera, Hymenoptera and Lepidoptera is given differently by each author with no very evident reason.

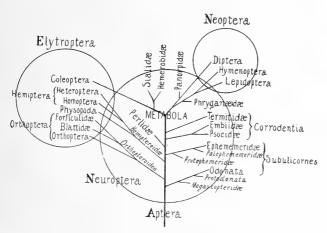


Figure 13. Diagram of the genetic relationships of the groups of insects and the three types of venation.

ORDERS OF INSECTS.

Coleoptera: spiracles and dorsal abdominal segments not visible from beneath.

Lepidoptera: densely covered with scales.

Diptera: hind wings club-like, or if wingless, thorax separated by constrictions from head and from abdomen, and without opposable jaws.

Hymenoptera: wings hooking together and front wings very narrow near the base, or if wingless, greatly constricted at base of abdomen.

Hemiptera: mouthparts tubular, or with long threadlike lancets, or very unsymmetrical, or wanting.

Orthoptera: front wings leathery, or if wingless, either front or hind legs are much enlarged, or body is flattened, or thorax is very slender cylindrical.

Corrodentia: ant-like or louse-like.

Neuroptera. Odonata: wings notched near the middle of the front edge. Aptera: wingless and legs shorter than body. Ephemerida: with three tails.

Table showing the Classification of Insects into Orders.

Orders of insects as given in this book.	1758 Linnæus.	Comstock.	Smith.	Folsom.	Kellogg.	Sanderson	Genera typical of all groups ever given rank as Orders.
	1758	1894	1897	1906	1905	1913	
1. Aptera.	7	1*	1	1*	1*	1	Lepisma. 1806 Machilis Latr. 1864 Japyx Halid. 1824 Campodea W.
Collembola.				2			Podura. 1806 Smynthurus Lat.
2. Neuroptera.	4	12	3	10	11	3	Hemerobius. 1834 Coniopteryx C. Raphidia. 1803 Sialis Latr.
Mecoptera. Trichoptera. Plecoptera.	(4)	$\frac{13}{14}$	2*	$\frac{11}{12}$	12 13 3	4 5 7	Panorpa. Phryganum. 1764 Perla Geof
3. Odonata.	(4)	3	(2)	7	4	8	Libellula.
4. Ephemerida.	(4)	2	(2)	6	2	6	Ephemera.
5. Corrodentia. Mallophaga. Isopoda	(7)	6 7 5	(2)	4*	6 7 5	9	1797 Psochus Latr. 1818 Menopon. Nitz. Termes. 1825 Embia La r.
6. Orthoptera.	(1)	9	4	3	8	2	Gryllus. Mantis. 1795 Phasma Licht. 1871 Hemimerus W.
Euplexoptera.		8					Blatta. Forficula.
7. Hemiptera.	2	11	5	9	9	10	Notonecta. Coccus. Aphis. Cicada.
Thysanoptera.	(7)	10*		8	10		Thrips.
8. Coleoptera.	1	18	6	14	14	11	Carabus. 1802 Stylops Kirby. 1869 Platypsylla W.
9. Diptera	6	16	9	15	15	13	Musca. Hippobosea.
Siphonaptera.	(7)	17		16			Pulex.
10. Hymenoptera.	5	19	8	17	17	14	Apis.
Lepidoptera.	3	15	7	13	16	12	Papilio.

^{1*} Thysanura. 2* Pseudoneuroptera. 4* Platyptera. 10* Physopoda.

LEPIDOPTERA.

The last of the orders of insects to appear on earth is the one comprising the moths and butterflies, these latter developing simultaneously with flowering plants and are generally conceded to be the most beautiful members of the class. The beauty of coloring is due to pigment in the scales which cover the body and which are developed to a degree not found in any other order. The pattern is always in mosaic the units of which are so small as rarely to be seen except under the microscope. The distinction between species is almost invariably based on the color pattern. Specimens that are battered and have lost a considerable portion of their scales therefore



Figure 14. Diagram showing the flight of a butterfly.

become often quite unidentifiable.

The most important characters for the classification of these insects are afforded by the venation of the wings. This is often quite hard to make out however because of the scales and can be best studied by bleaching the wings (see appendix.) Most of the features can generally be determined by examining the wings from beneath. The commonest nomenclature for the veins is to number them in order from behind forward using 1a. and 1b. when there are two veins behind the large cell instead of one as is usual.

A plan of wing formulæ has been devised, based on the common system of nomenclature but applying the numbers to the connecting veins or bars instead of those proceeding to the margin; bar 2 being between veins 1 and 2. When veins fork from a common stem it is indicated by an * thus 8* is the common stem of 7 and 8. The formula consists of a list of the bars

in the order of size, enclosing in parentheses those of approximately equal size. The use of such formulæ greatly facilitates identifications.

The following formulæ show the venation of our common larger butterflies.

Almost the only other characters besides those afforded by the wings are those of the mouth. This differs radically from that of other insects. The mandibles are wanting or represented by the merest rudiments in a few moths. The labium is usually represented by a pair of strongly developed palpi and the maxillæ have combined to form a single tube which at rest lies

coiled up is a spiral between the palpi. In some of the lower moths the maxillary palpi are also present. The characters used in classification are the relative size, position and clothing of the three-jointed palpi.

The larvæ of Lepidoptera have usually 16 legs, the first two and the next to the last abdominal segments being legless. Some have a less number by the loss of the more anterior pairs of abdominal legs, the minimum number being ten. All abdominal legs differ in structure from the thoracic legs, and are often called pro-legs.

The pupe have the appendages cemented fast to the body except in a few of the lowest moths.

The classification of Lepidoptera of longest standing is the separation



Figure 15. The head and mouthparts of a larva of a moth.

of the diurnals, butterflies, from the moths Another division commonly made is the separation of the smaller forms as microlepidoptera. Recently the forms possessing a finger-like projection (jugum) near the base of the hind edge of the front wing have been placed by themselves as the jugatæ. The families Sphingidæ and Saturnidæ comprising our largest moths have each been separated as primary groups.

SYNOPSIS OF FAMILIES.

Noctuidæ: cell of front wings closed by a cross-vein in three sections, a large feeble semicircular portion followed by two small, nearly equal transverse portions. Agaristidæ: antennæ: enlarged outwardly. Nycteolidæ: front wings not arched at base.

Geometridæ: two large, nearly equal sections of cross-vein at end of cell

and antennæ not knobbed at tip. Notodontidæ, and Bombycidæ: anterior vein almost straight near base, the latter without proboscis.

Pyralidæ: hind wings with posterior area distinctly wider than the costal and median areas combined.

Tortricidæ: costal area of front wings wider than cell, and palpi obtuse.

Lycænidæ: antennæ knobbed and eyes not further apart than half their vertical height. Riordinidæ: anterior vein forked near base.

Nymphalidæ: antennæ knobbed and front legs much smaller than others. Agapetidæ: some of the veins greatly swollen near base. Lymnadidæ: with small cell between anterior vein and its basal branch.

Tineidæ: head rough haired or antennæ with basal eye cap.

Pterophoridæ: wings divided plume-like.

Hesperidæ: antennæ knobbed and far apart at base.

Gelechiidæ: anterior vein of hind wings connected with cell, and three veins beyond the posterior vein. Xylorictidæ: outer branch of primary vein of hind wing not reaching the costa.

Hyponomeutidæ: wings of nearly equal size, hind wings not heavily fringed.

Arctiidæ: anterior vein of hind wing arising from middle of cell. Lithosiidæ: without ocelli.

Pieridæ: antennæ knobbed. Papilionidæ and Parnassiidæ: inner edge of hind wings concave; the former has long tails on hind wing.

Œcophoridæ: wings narrow oval or lanceolate, primary not approximate but nearly parallel with independant vein in hind wing. Blastobasidæ: fringe of front wing making inner edge appear concave.

Elachistidæ: wings narrow oval or lanceolate.

Sphingidæ: end of cell of front wings very oblique.

Sessiidæ: cell of front wing open. Thyridæ: two independents connected with posterior vein in front wing.

Saturnidæ: cell of front wing less than half the length of the wing. Lasiocampidæ, Nolidæ and Dioptidæ: the first two with posterior vein of front wing apparently four-branched, and the last two having frenulas.

Hepialidæ: independent veins crosing cell of front wing. Micropterygidæ: cell open. Cossidæ and Psychidæ: no jugum on front wing, the former with wings spotted.

Syntomidæ. Thyatiridæ: with posterior vein of front wing apparently three-branched. Platypterygidæ: cell of hind wing much shorter on anterior side. Liparidæ and Pericopidæ: primary and independent veins of hind wings stalked, the latter with large spots on wing.

PAPILIONINA — Butterflies.

Literature:— Holland, Butterfly Book. Wright, Butterflies of the West Coast of the United States.

PARNASSIIDÆ.

These butterflies live in the Sierras, the larvæ feed on Sedum and Saxifraga.

Parnassius baldur—clodius.

behrii—smintheus.

clarius—clodius.

claudius Men.

menetresii—claudius. nomion (Alaska.) smintheus Edw.

PAPILIONIDÆ.

Swallow tail butterflies, the larvæ mostly feeding on Umbelliferæ, but L. philenor feeds on Aristolochia, P. eurymedon on Rhamnus californicus and P. rutulus on willow, alder and apple.

Euplædes troilus-Papilio. Jasoniades daunus-Papilio. eurymedon-Papilio. pillumnus (not California.) rutulus-Papilio. Leartius arcelisaus (not California.) mylotes—(not California.) philenor (Linn.) Papilio americanus Koll. asterias-polyxenes. bardii (Edw.) californica-zolicon. caladon Lucas. danus (not California.) eurymedon Boisd. hirsuta skin. indra Reak. machaon Linn. mylotes (not California.) pergamus-indra. philenor-Leartias polyxenes Fabr. rutulus Boisd. troilus (not California).

zolicon Boisd.



Figure 16. Diagram of butterfly venation. Dotted lines indicate veins sometimes absent.

PIERIDÆ.

The only family of butterflies containing highly injurious species, includes the beautiful orange tipped butterflies Synchlæ, the white butterflies Pontia and a number of genera of yellow forms.

SYNOPSIS OF GENERA.

Eurymus: color yellow. Nathalis: black dash on hind edge of front wing. Callydrias: without black markings. Zerene: with only a black dot at end of cell in female, and nearly half the wing black in male. Eurema: black band on wing not tapering at each end.

Synchic: wings conspicuously mottled beneath.

Pontia. Neophasia: with distinct black mark on costa to end of cell.

Anthocharis angelina—Synchlœ cethura. ansonia (not California).
ausonides—Synchlæ.

caliente Synchlœ.
cooperi—Synchlœ cethura.
cethura—Synchlœ.
creusa—Synchlœ.
edwardsii—Synchlœ lanceolata.
hyantis—Synchlœ ausonides.
lanceolata Synchlœ.
lotta (not California).
morrisoni—Synchlœ. cethura.
reakirtii—Synchlœ sara.
sara—Synchlœ.
stella—Synchlœ sara.
Callidrias eubule(Linn.)
Colias adriane—Eurymus eurytheme.
alexandra—Eurymus.

amphidisca-Euryms eurytheme.



Figure 17. Diagram illustrating the flight of a butterfly. A. wing elevated. B. wing depressed. EFGH.plane cutting wing at I. K. projection of path of I.

barbara-Eurymus harfordi. behrii-Eurymus. cæsonia-Zerene. californica-Eurymus eurythechrysomelas-Eurymus occidenchrysthostheme (not California). edusa-Eurymus eurytheme. edwardsii-Eurymus. emelia-Eurymus alexandra. eurydice-Zerene. eurytheme-Eurymus. hagenii-Eurymus eurytheme. harfordi-Eurymus. hyale (not California.) interior (eastern.) keewadin-Eurymus eurytheme. occidentalis-Eurymus. phylodice (eastern.)

rutilans (undetermined). scudderi-Eurymus. wosnesenski-Eurymus. Eucherra menapia-Neophasia. Euchlæ ansonoides-Synchlæ. cethura-Synchice. creusa-Synchice. lanceolata-Synchice. sara-Synchice. Eurema nicippe (Cram.) Eurymus alexandra (Edw.) behrii (Edw.) emelia-alexandra. eurytheme (Boisd.) harfordi (Edw.) interior (eastern.) occidentalis (Scud.) phylodice (eastern). scudderi (Reak.) Gonepteryx rhamni-Zerene eurydice. Meganostoma cæsonia-Zerene. eurydice-Zerene. Midea lanceolata-Synchice Nathalis iole Boisd. Neophasia menapia Feld. terlooii Behr. Papilio eubule—Callydrias. cæsonia-Zerene. nicippe-Eurema. napi-Pontia. rapæ-Pontia. Pieris ansonia (not California). autodice (not California., beckeri-Pontia. calyce-Pontia occidentalis. castoria-Pontia napi. chloridice-Pontia beckeri. flava-Pontia napi. lanceolata-Synchice. leucodice (not California). marginalis-Pontia rapæ. menapia-Neophasia. napi-Pontia. nausturtii-Pontia napi. occidentalis-Pontia. oleracea-Pontia napi. pallida--napi. protodice-Pontia. rapæ-Pontia. sara-Synchice. sisymbri-Pontia. venosa-Pontia napi. yreka-Pontia rapæ.

Pontia 1758 rapæ. napi: no definite black patch at tip of front wings. 1833

protodice: veins of hind wings broadly bordered with black. 1854 sisymbri: veins black above. 1866 occidentalis: veins of hind wings narrowly bordered with black. 1871 beckeri: somewhat mottled beneath with green.

Pontia beckeri (Edw.) napi (Linn.) occidentalis (Reak.) protodice (B. & L.) rapæ (Linn.) sisymbri (Boisd.)

Rhodocera rhamni-Zerene eurydice. Synchloe ausonides (Boisd.)

> australis Gr. caliente (Wr.) cethura Feld.

creusa (D. & H.) flora—sara. lanceolata (Boisd.) lotta Beut.

sara Boisd. Terias midea (undetermined).

mexicana (eastern). nicippe-Eurema.

Xanthidia mexicana (not California). Zerene cæsonia Stoll.

eurydice Boisd.

NYMPHALIDÆ.

This family shows the most diversity of form among butterflies. The food habits of the larvæ are as follows: - Oaks Adelpha and Basilarchia lorquini. Elm Euvanessa. Poplar Euvanessa and Basilarchia archippus. Willow Euvanessa, Basilarchia archippus and Polygonia faunus. Ceanothus Eugonia. Thistle Phyciodes mylitta. Nettle Aglais, Polygonia satyrus Vanessa atlanta and cardui. Azalea Polygonia silvius and zephyrus. Passion flower Agraulis and Euptoieta. Violets Argynnis, Brenthus and Euptoieta. Scrophulariaceæ Lemonias. Hops and Bæhmeria Vanessa atlanta. Gnaphalium and Antennaria Vanessa huntera. Cnicus, Carduus and Althæa Vanessa cardui. Lavatera assurgentiflora and Malva Vanessa caryæ. Plantago, Gerardia and Antirrhinum Junonia.

A migration of very great numbers of Eugonia ocurred in 1912 in the northern part of the state, and a few years before in southern California Vanessa cardui flew in equally great numbers.

SYNOPSIS OF GENERA.

Argynnis: wings mottled with brown or black including a row of round black dots in the center of a broad submarginal band across both wings. Brenthus: these spots also beneath. Euptoieta: median band paler than submarginal.

Lemonias: under side of hind wings much paler than front wings. Phyciodes: second joint of palpi enlarged. Thesalia: more than half of the hind wing beneath vellow.

Polygonia: outer edge of wings angular. Junonia: wings with large eyespots above. Euvanessa: wings black with pale border. Aglais: reddish band across wings just within black border. Vanessa: hind wings spotted beneath. Eugonia: no silver spots beneath on hind wing.

Basilarchia. Agraulis: front wings more than twice as long as broad. Limenitis: eyes hairy.

Adelpha bredowii-Liminites bredowii. Apatura drummondi Kirby. californica-Limenites bredowii. Argynnis adiante-adiaset. Aglais milberti (Goda.) adiaste Behr. adraste-adiaste. Agraulis vanillæ (Linn.)

aglaja-edwardsii. arge-eurynome. atossa Edw. behrensii Edw. bellona (eastern). bremneri Edw. callippe Boisd. chitone Edw. coronis Behr. cybele-leto. edwardsii Reak. egleis Boisd. egleis-montivaga. epithore-Brenthis. eurynome Edw. hegesia-Euptoieta. hippolyta Edw. hydaspe-Zerene. inornata Edw. irene-ruprestris.



Figure 18. Junonia cœnia.

juba-coronia. laura Edw. liliana Edw. macaria-eurynome. monticola Behr. montivaga Behr montivaga-egleis. montevaga-irene. mormoria-egleis. nenoquis-egleis. nevadensis Edw. nokomis Edw. oweni-hippolyta. purpurascens-monticola. ruprestris Behr. semiramus Edw. zerene Boisd. Basilarchia archippus Cram. arthemis (not California).

astynax (not California).

lorquini (Boisd.) weidemeyer (not California). Brenthis bellona (eastern). epithora (Boisd. morrisoni (not California). myrina (eastern). nenoquis (not California). Charidryas carloa (not California.) nycteis (not California). Chlorippe antoria (not California). celtis (not California). leila (not California). Dione vanillæ—Agraulis. Eugonia californica (Boisd.) Eresia hermas (undet rmined). punctata (not California). Euptoieta claudia (Cram.) Euvanessa antiopa (Linn.) Grapta c-album-Polygonia oreas. hegesia Cram. faunus-Polygonia. marysas-polygonia. oreas-Polygonia. rusticus-Polygonia faunus. satyrus-Polygonia. silens-Polygonia oreas. silvius-Polygonia. zephyrus-Polygonia. Junonia ccenia Hueb. genovera-cœnia. lavinia—cœnia. orvthia-conia. Heterochroa bredowii-Limenitis. californica-Limenitis bredowii. eulalia-Limenitis bredowii. Kodiosoma lorquini-Basilarchia. Lemonias anicia D.& H.) augusta (Edw.) baroni (Edw.) chalcedon (D.& H.) cooperi (Behr.) edetha (Boisd.) gabii (Behr.) hoffmani (Behr. macqlashani (Riv.) nubigena (Behr.) palla (Boisd.) quino (Behr.) rubicunda (Edw.) whitneyi (Behr.) Liminitis bredowii (Hubn.) eulula-bredowii.

lorquini-Basilarchia.

Melitæa anicia-Lemonias.

dissippus-archippus.

augusta-Lemonias. zerena-Argynnis. Nymphalis lorquini-Basilarchia. baroni-Lemonias. campestris-Phyciodes pratensis. Papilio antiopa-Euvanessa. canace-Phyciodes picta. atlanta-Vanessa. chalcedon-Lemonias. cardui-Vanessa. callina-Phpciodes mylitta. claudia-Euptoieta. collina-Phycioides mylitta. hegesia-Euptoieta. cooperi—Lemonias. dwinelli—Lemonias chalcedon. huntera— Vanessa. vanillæ—Agraulis. editha-Lemonias. Phycioides canace-picta. hermas (not California.) epula-Phycioides mylitta. gabii-Lemonias. montana (Behr.) mylitta (Edw.) gloriosa (undetermined). helcita-Lemonias hoffmani. orseis-pratensis. hermes (undetermined). picta (Edw.) hoffmani-Lemonias. pratensis (Behr.) leanira—Thesalia. tharos (not California). macglashani-Lemonias. Polygonia faunus (Edw.) montana-Phycioides. interrigationis (not California). mylitta-Phycioides. oreas (Edw.) nubigena-Lemonias. rusticus-faunus. obliterata-Thesalia leanira. satyrus (Edw.) obsoleta-Thesalia leanira. silenus-oreas. orseis-Phycioides pratensis. silvius (Edw.) palla-Lemonias. zephyrus (Edw.) pratensis-Phycioides. Pyrameis atlanta-Vanessa. pola-Phycioides whitneyi. cardui-Vanessa. pulchella—Phycioides mylitta. pulchella—Phycioides pratensis. carye-Vanessa. elymi-Vanessa cardui. cuino-Lemonias. huntera-Vanessa. rubicunda-Lemonias. Rhodocera lorquini-Basilarchia sonoræ-Lemonias gabbi. Thesalia leanira (Boisd.) thecla-Thesalia. thekla (Edw.) theona-Thesalia. theona (Men.) whitneyi-Lemonias. wrightii (Edw.) wrightii-Thesalia.

Vanessa. 1758 cardui. atlanta: red band across front wings. 1775 huntera: two large eyespots beneath hind wings. 1806 carye: black band across cell of front wings.

Vanessa antiopa—Euvanessa.

atlanta (Linn.)
californica—Eugonia.
cardui (Linn.)

carye Hueb. huntera (Fabr.)

marsyas-Polygonia satyrus.

milberti—Aglais.

oreas-Polygonia.

rusticus-Polygonia faunus.

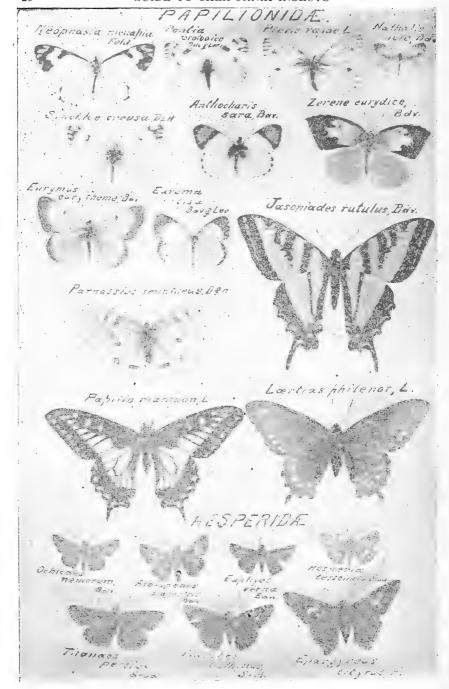
satyrus—Polygonia. silvius—Polygonia.

zephyrus—Polygonia.

AGAPETIDÆ.

These butterflies have been called nymphs or satyrs and our commonest genus Comonympha, ringlets. All of the species as far as known feed as larvæ on grasses and sedges and when just hatched have very large heads.

atlantus (Gr.) baroni (not California). paulus (Edw.) meadii (not California). œtus (Boisd.) Cercyonis alope (Fabr.)



sylvestris (Edw.) stephani (Wr.) wheeleri (Edw.) Chionobas californicus—Œneis nevadensis. chryxus-Œneis. galactinus-Coenonympha californica. iduna--Œneis nevadensis. ivallda--Œneis chryxus. nevadensis-CEneis. Cœnonympha brenda-ochracea. californica D.& H. eryngii-californica. galactina-californica. inornata (not California). ochracea Edw. panphilioides-pamphilius. pamphilius (Linn.) pulla-californica. Hipparchia boopis-Cercyonis alope. sylvestris-Cercyonis œtus.

Libythea bachmanii (not california.)

stephani-Cercyonis.

sthenele (Boisd.)

carineta (not California). Neominois ridingsi (not California). Neonympha henshawi (not California). rubrica (not California). Œneis californica—nevadensis. chryxus (D.& H.) iduna-nevadensis. ivallda-chryxus. nevadensis (Feld.) macounii (eastern). Papilio alope-Cercyonis. pamphilius-Coenonympha. Satyrus alope-Cercyonis alope. adriane-Cercyonis alope. atlantus-Cercyonis. baroni-Cercyonis alope. boopis Cercyone alope. californica-Cononympha. charon-Cercyonis alope. nephele-Cercyonis alope. œtus-Cercyonis alope. paulis-Cercyone. silvestris-Cercyonis. sthenele-Cercyonis. wheeleri-Cercyonis.

ITHOMIIDÆ.

These are southern forms only rarely reaching California. The food habits of very few are accurately known.

Ceratinia lycaste-Dynothea. Dynothea lycaste (Fabr.) Ithomia lycaste-Dynothea.

Mechanitis californica Reak. Papilio lycaste-Dynothea. Papilio lycaste-Dynothea.

LYMNADIDÆ.

The common well known milkweed butterfly sometimes called the monarch. Sometimes these butterflies assemble in dense swarms which when alighting on a tree almost hide the color of the leaves.

Anosia plexippus (Linn.)

Danais archippus-Anosia plexippus.

RIODINIDÆ.

A small family closely allied to the Lycenide. Food habits unknown. Apodemia mormo-Chrysobia. Calephilis australis—(Edw.) nemesis Edw Charis australis-Calephelis. Chrysobia mormo (Feld.)

Lemonias australis-Calephelis. mormo—Chrysobia. virgulti—Chrysobia. Nemeobius virgulti--Chrysobia.

LYCÆNIDÆ.

The dainty little blue and copper colored butterflies constitute this family.

A number of species feed on oak; others are rather general feeders. The habits of very few are accurately known.

Agriades podarce (Feld.) Atlides halesus (Cram.) Brephidium exilis (Boisd.) Callophrys apama (not California). dumetorum (Boisd.) Callipsyche behrii (Edw.) Chalceria cupreus (Edw.) Chrysophanes americana (eastern) arota-Tharsalia. cupreus-Chalceria. editha-Gædes. fasciata (eastern). gorgon-Gædes. helloides—Epidemia. hermes—Tharsalia. hypophleas (eastern). mariposa-Epidemia. virginiensis-Tharsalia. xanthoides-Gæides. zeræ-Epidemia. Cupido ardea (Edw.) clara (Edw.) dædalus-icarioides. fulla (Edw.) heteronea (Boisd.) hilda Gr. icarioides (Boisd.) pheres (Boisd.) sæpiolus (Boisd.) Cyaniris ladon Cram. pseudargoilus-ladon. Epidemia helloides (Boisd.) Everes amyntula (Boisd.) monica (Reak.) tejua (undetermined). Gædes editha (Barnes). gorgon (Boisd.) xanthoides (Boisd.) Habrodias grunus (Boisd.) Helodes hypophlæus (not California.) Hemiargus isola (not California). Hypauratus crysalus (Edw.) Incisalia angusta (eastern). eryphon (Boisd.) iroides (Boisd.) Leptotes mariana (Reak.) striata (Edw.) Lycæna acmon-Rusticus. amyntula-Everes. anna-Rusticus. antiacis-Nomiades.

arota-Tharsalia.

argyrotoxus-Rusticus anna. battoides-Rusticus. behrii-Nomiades antiacus. cajona-Rusticus anna. catalina-Phædrotes sagittigera. cilla—Agriades. clara—Cupido. cupreus-Chalceria. dædalus-Cupido iraroides. echo-Cyaniris ladon. enoptes-Rusticus. erymus-Cupido icaroides. evius-Cupido pheres. exilis-Brephidium. fuliginosa-Satyrum. fulla-Cupido. helios-Cupido phileros. helloides-Epidemia. hermes-Tharsalia. heteronea-Cupido. icaroides-Cupido. lotis-Rusticus. lupini-Rusticus shasta. lygdamus—Nomiades. maricopa—Icaroides. mariposa—Epidemia. marina-Leptotes. mertila-Nomiades antiacis. mintha-Cupido icaroides. monica-Everes. orbitulus (not California). orcus-Nomiades lygdamus. pardalis-Cupido icaroides. pheres-Coupido. philemon—Rusticus anna. phileros—Cupido. piasus-Cyanirus ladon. podarce-Agriades. polyphemus-Nomiades antiacis. pseudargoilus-Cyanirus ladon. regia-Philotes sonoriensis. rhæa-Phædrotes sagittigera. rustica (not California) sæpiolus-Cupido. sagittigera-Phædrotes. scudderi (eastern). shasta-Rusticus. sonorensis-Philotes. speciosa-Phædrotes. striata-Leptotes. tehama-Agriades podarce. Satyrium fuliginosa (Edw.)

ardea---Cupido. Thanaos pernigra Gr. Strymon melinus-Oranotes. Tharsalia arota (Boisd.) hermes (Edw.) virginienssis (Edw.) Thecla acadica-californica. acis (eastern). adenostomatis Edw. angustus (eastern). auretorum Boisd. behrii-Callipsyche. blendina (not California) californica Edw. chalcis Behr. crysalus—Hypaurotus. cygnus-californicus. dryope Edw. dumetorum-Callophrys. exolita-nelsonii. euryphor-Incisa lia. fuliginose—Satrium. fulvescens—sæpium. grunus-Habrodias. halesus-Atlides. ilavia Beut. iroides-Incisalia. loki Sk. melinus-Uranotes. mirabile-ilavia. muiri-nelsonii. nelsonii Boisd pudica-Uranotes melinus. sæpium Boisd. spadix Edw. spinetorum Boisd. sylvius Boisd. tacita Edw. tetra Behr.

tejuna (undetermined). viaca-Phædrotes sagittigera. xanthoides-Gæides. xerxes-Nomiades. virginiensis-Tharsalia. Metura acis (eastern). Nomiades antiacis (Boisd.) lygdamus (Doub.) xerxes (Boisd.) Papilio halesinus-Atlides. Phædrotes sagittigera (Feld.) speciosa (Edw.) Philotes sonorensis (Feld.) speciosa-Phædrotes. Polymmatus amyntula—Everes. antægon-Rusticus acmon. antiacis-Nomiades. arota-Tharsalia. enoptes-Rusticus. exilis-Brephidium. gorgon-Gæides. helloides-Epidemia. heteronea-Cupido. hypophleas (eastern). icaroides-Incisalia. nivalis-Epidemia mariposa. pheres-Cupido. piasus-Cyaniris ladon. sæpialus-Cupido. xanthoides-Gæides. xerxes-Nomiades. Rusticus acmon (D.& H.) anna (Edw.) battoides (Behr.) chlorina Skin. enoptes (Boisd.) lotis (Lintn.) neurona Skin. scudderi (eastern).

HESPERIDÆ.

The small heavy bodied butterflies form this family. They are considered the nearest allied to the moths. Epargyreus feeds on Wistaria, Eudamus pylades on clover and other plants and Pholisora catulla on lambsquarter. Achalarus cellus (not California).

Amblyscirtes ænus Edw. simius Edw. Anatolmis regularis Gr.

Anchyloxypha arene (Edw.)

Uranotes alcestis (not California.)

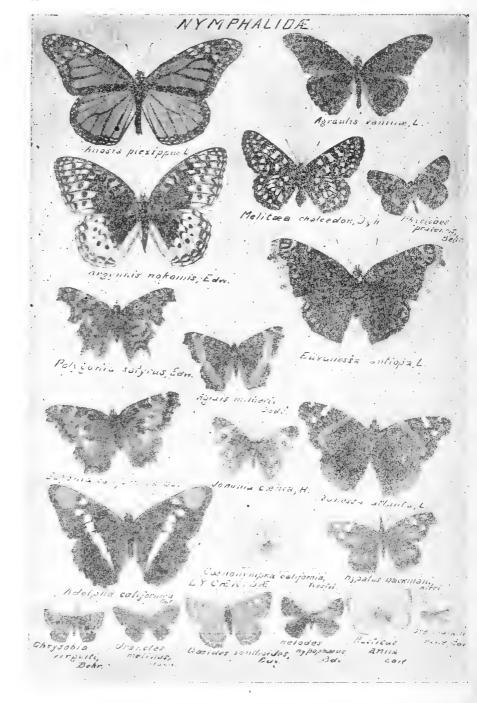
melinus (Hueb.)

numitor (not California).

Anthomaster agricola (Boisd.) nemorum (Boisd.) pratincola (Boisd.) sylvanoides (Boisd.) verus (Edw.)

shasta (Edw.)

Atalopedes campestris (Boisd.)



Prenes errans Skin. morrisonii (Edw.) Pyrgus cæspitalis-Hesperia. Atrytone melane-Phycanassa. ericetorum.. Hesperia. taxiles Edw. petreius-Hesperia cæspitalis. Calpodes rhena Edw. ricara-Hesperia cæspitalis. Carterocephalus arane—Anchyloxypha. syrichtus-Hesperia. californicus-Potanthus dara. manden-Pamphilia palæmon. tristis-Thanaos. omaha-Potanthus dara. Ochlodes agricola-Anthomaster. Cocceius pylades-Eudamus. nemorum-Anthomaster. Copæodes arene—Ancyloxypha. pratincola-Anthomaster. eunus Edw. sylvanoides-Anthomaster. procris Edw. verus-Anthomaster. wrightii Edw. Pamphilia agricola-Anthomaster. Epargyreus exadeus-Eudamus. aragos (not California). tityrus (Fabr.) cabeus-Erynnis. Erynnis cabelus Edw. californicus Wr. columbia-comma. campestris-Anthomaster. comma (Linn.) chiapa Wr. juba-comma. colorado-Erynnis comma. manitoba comma. columbia-Erynnis comma. oregona—comma. ruricola—Atrytona. comma—Erynnis. errans—Prenes. huron—Atalopedes campestris. taxilis-Atrytona. Eudamus æmilea Skin. idaho-Erynnis comma. albofasciatus (not California). juba-Erynnis comma. manataaqua-Limochrœs. exadeus Cram. mandan (not California). mexicana H. S. nevada-mexicana. manitoba-Erynnis comma. pylades Scud. melane-Phycanassa. sympticius (not California). nemorum-Anthomaster. tityrus—Epargyreus. Euphyes verna (not California). omaha (not California). oregona-Erynnis comma. vestris (Boisd.) osceola-vestris. Herperia agricola—Anthomaster. palæmon Pall. cæspitalis (Boisd.) pratincola-Anthomaster. campestris-Hylephila. phylæus-Hylephila. comma-Erynnis. ruricola-Atrytone. ericetorum (Boisd.) sabuleti-Polites. melane-Phycanassa. sylvanoides-Anthomaster. nemorum-Anthomaster. sylvanoides-Erynnis comma. pratincola-Anthomaster. sylvanus (European). sabuleti—Polites. ruricola—Atrytone. taxilis—Atrytone verus-Anthomaster. scriptura (Boisd.) vestris-Euphyes. sylvanoides-Anthomaster. yreka-Anthomaster nemorum. sylvanus (European). Papilio comma-Erynnis. syrithtus (Fabr.) phylæus-Hylephila. syrichtus-Hesperia. tessellata Scud. vestris-Euphyes. Photisora alpheus Edw. Hylephila campestris-Atalopedes. catullus (Fabr.) morrisonii-Atalopedes. libya Scud. phylæus (Drury.) Phycanassa melane (Edw.) Larema deva Edw. Polites sabuleti (Boisd.) Leroda comus (not California). Potanthus dara (Kol.) Limochrœs cerna-manataaqua.

manataaqua (Scud.)

californica-dara.

phylace (Edw.)
Nisioniades cervantes (European.)
funeralis—Thanaos.
propertius—Thanaos.
tages (European).
tessellata—Hesperia.
cæspitalis—Hesperia.
Syrichtus cæspitalis—Hesperia.
ericetorum—Hesperia.
ruralis (not California).
scriptura—Hesperia.
tessellatus—Hesperia.
Thanaos brizo B. & .
cervantes (European).
funeralis S. & A.

icelus (not California).

illius Dyer.

juvenalis (not California.)

persius (Scud.)

propertius (Linn.)

tages (European).

tribullus S. & B.

tristis Boisd.

Thorybes æmilea—Eudamus.

bathyllus (eastern).

mexicana—Eudamus mexicana.

pylades—Eudamus

Thymelious brettus (B. & L.)

erynnioides Dyar.

SPHINGINA — Hawkmoths.

Monograph: - Rothschild, Revision of the Lepidopterous Family Sphingidæ.

SPHINGIDÆ.

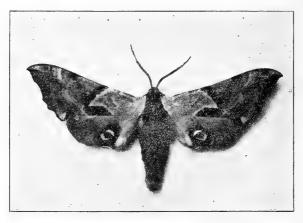


Figure 22. Pachysphinx modesta

The sphinx moths include two important pests; the tobacco or tomato worm Protoparce and Pholus that attacks the grape and Ampelopsis. Other species of little economic importance are: Sphinx on willow, Pachysphinx on willow and poplar, Hyloicus on wild cherry, ash and privet, and Celario on portulaca and other weeds.

SYNOPSIS OF GENERA.

Hyloicus: markings on front wings longitudinal. Celario: veins white. Errinyis: no pale band across hind wings.

Protoparce: front wings with cross bands. Sphinx: eye spots on hind wings.

Arctonotus: bands in pairs. Pachysphinx: basal third of front wings pale. Euproserpinus and Proserpinus: with broad border on hind wings, the latter with base of hind wings red.

Hæmorrhagia: wings in part transparent.

Anceryx ello-Erinnus. Arctonotus lucidus Boisd. Celerio intermedia (Kirby.)

lineata (Fabr.) Chærocampa procne (undetermined). Pholus achemon (Drury). Cryptopogon ophthalmicus—Sphynx Proserpinus clarkiæ (Boisd.) cerasyi.

Deilephila daucus-Celario lineata. grafii-Celario intermedia.

intermedia-Celerio. lineata-Celario.

Dilophonota ello-Erinnus. Erinnus ello (Linn:)

Euproserpinus euterpe (Edw.)

phæton (G. & R.) Hæmorrhagia senta (Stretch).

thetis (Boisd.)

thetis. diffinis-Hæmorrhagia senta. diffiinis-Hæmorrhagia thetis.

paipalis-Hæmorrhagia thetis. rubens-Hæmorrhagia senta.

thetis—Hæmorrhagia. thetis-Hæmorrhagia senta.

Hyloicus chersis (Hueb.) drupiferarum (S. & A.) lugens (Walk.) perelegans (Edw.) sequoiæ (Boisd.) vancouverensis (Edw.)

Lepisesia clarkiæ--Proserpinus. phæton-Euproserpinus.

Lethia chersis-Hyloicus. Lintneria perelegans-Hyloicus.

erata-Euproserpinus Macroglossa phæton.

phæton-Euproserpinus.

senta-Hæmorrhagia. thetis—Hæmorrhagia. Pachysphynx modesta (Harr.)

Philampelus achemon—Pholus.

Protoparce quinquemaculata Haw. sexta Johan.

Pteropogon clarkiæ-Proserpinus.

Sesia thetis-Hæmorrhagia.

Smerintaus imperator—Pachysphynx modesta.

modesta-Pachysphynx.

ophthalmicus-Hyloicus vancouverensis.

pallidulus-Hyloicus vancouverensis

Hemeris cyanoglossum—Hæmorrhagia Sphynx achemon—Pholus. carolina-Hyloicus. cerisyi Kirby.

chersis-Hyloicus. drupiferarum—Hyloicus.

ello-Erinnus. lineolata—Hyloicus. lugens-Hyloicus.

modesta-Pachysphynx. oreodaphne-Hyloicus chersis.

perelegans-Hyloicus.

quinquemaculata-Protoparce. sequoiæ-Hyloicus.

strobi (not California). vancouverensis-Hyloicus.

Triptopogon imperator-Pachysphynx modesta.

modesta-Pachysphynx.

occidentalis-Pachysphynx desta.

SATURNINA.

SATURNIIDÆ.

The Saturniidæ include the largest moths. None are very injurious tho Telea feeds on many plants including fruit trees. Samia feeds on Ceanothus.

SYNOPSIS OF GENERA.

Hemileuca. Saturnia: hind wings black. Telea: a small transparent spot

on each wing. Samia: eye spot at tip of front wing. Saturnia: eye spot on middle of wing.

Attacus ceanothi—Samia rubra. polyphemus—Telia.

Calosaturnia mendocino—Saturnia. Dryocampa riversii (undetermined).

Hemileuca artemis—nevadensis. californica—nevadensis. electa Wr.

> lucina—nevadensis. nevadensis Str. neumægenii Edw.

Platysamia californica—Samia rubra.
Pseudohazis denudata—eleganterina.

eleganterina (Boisd.) shastensis—eleganterina.

Samia californica—rubra. ceanothi—rubra. euryalis—rubra. rubra Behr.

Saturnia californica—Samia rubra.
ceanothi—Samia rubra.
eleganterina—Pseudohazis.
denudata—Pseudohazis eleganterina.

mendocino Behrens.
Telea ceanothi—Samia rubra.
eleganterina—Pseudohazis.
polyphemus (Cram.)

BOMBYCINA.

SYNTOMIDÆ.

Day flying moths with wings shaped somewhat like those of a wasp. ${\bf SYNOPSIS\ OF\ GENERA}.$

Ctenucha. Lycomorpha:: front wings red. Scepsis: small,spread of wings about $30\ \mathrm{m.m.}$

Apitosia multifaria—Ctenucha. Ctenucha brunnea (Stretch.)

cha brunnea (Stretch.)
corvina—rubroscapus.
harrisii (undetermined).
luteoscapsis—multifaria.
multifaria Walk.
orthoscapsis—rubroscapus

orthoscapsis—rubroscapus. robinsonii (undetermined).

rubroscapus (Men.) Glaucopsis rubroscapus—Ctenucha.

Lycomorpha fulgens Edw. fulvicollis (eastern). Scepsis gravis— wrightii. packardi Grote. wrightii Stretch.

LITHOSIIDÆ.

The moths of this family feed on lichens.

Cisthene faustinula—Illice.

lactea—Clemensia. nexa—Illica.

Clemensia albata Pack

lacteata Stretch.
Illice faustinula Boisd.
nexa Boisd.

ARCTIIDÆ.

Monograph:—Hampson, Catalogue of the Lepidoptera Phalænæ of the British museum. Vol. III.

Æmilia roseata (Walk.) Ammalo tenera (Hueb.)

Antarctia proba—Diacrisia vagans.
punctata—Diacrisia vagans.

nevadensis—Apantesis. ornata—Apantesis.

shastensis—Apantesis nevadensis

simplicior—Apantesis ornata:

rubra Diacrisia. Apantesis arge (Drury.) blakei (Grote).

> nevadensis (G. & R.). ornata (Pack.). proxima (Guer.).

Arachnis aulæa (not California).
picta (Pack.).

Arctia achaia—Apantesis ornata.
arge—Apantesis.
blakei—Apantesis.
bolanderi—Apantesis blakei.
caia (Linn.).
dahurica—Apantesis ornata.
docta—Apantesis proxima.
doris—Apantesis arge.
edwardsii—Apantesis ornata.
fuliginosa—Phragmatobia.
geneura—Apantesis nevadensis.
nerea—Apantesis.
vagans—Diacrisia.

Cycnia tenera—Ammalo.
Diacrisia rubra (Neum.)
vagans (Boisd.).
virgincia (Fabr.).
Ecpantheria deflorata (Fabr.)
incarnata—Lerina.
permaculata—Turuptiana.
scribonia—deflorata.
Epicallia guttata—Platyprepia virginalis.
virginalis—Platyprepia.
Euchætes elegans—Pygarctia.
sciurus—Ammalo tenera.
scudderi—Parasemia plantaginis.

yosemite-Ammalo tenera.

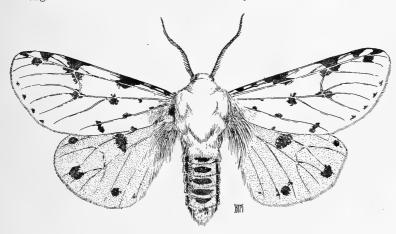


Figure 23. Eustigmene acreæ.

virginalis-Platyprepia. Bombyx acreæ-Eustigmene. caia-Arcita. deflorata-Ecpantheria. plantaginis-Parasemia. virginica-Diacrisia. Callarctia ornata—Apantesis. Callimorpha lecontei-Haploa. Chelonia achaia-Apantesis ornata. proxima-Apantesis. sciurus-Isia isabella. virginalis-Platyprepia. Cordiosoma fulvum-Kodiosoma. nigrum-Kodiosoma fulva. Ctenucha harrissi-Pygoctenucha terminalis. robinsonii-Lerina incarnata.

Euprepia blakei-Apantesis. caia-Arctia. Euschausia argentata (Pack.) Eustigmene acreæ (Drury). albida (Strech). Eutrepia acajii-Arctia caia. Euverna clio (Pack.) Halisidota agassizii-maculata. alni-maculata. argentata—Euschausia. californica—maculata. edwardsii—Hemihyalea. maculata (Harr.) roseata-Aemilia. sobrina-Euschausia. euschansia-Argentata. Haploa lecontei (Boisd.)

Mænas vestalis (Pack.) Hemihyalea edwardsii (Pack.) Paasemia Hyphantria textor Harr. Nemeophile. cæspitalis Isia isabella (S. & A.) plantaginis. chicorii-Parasemia plantaginis. Kodiosoma fulva Stretch. clio-Euverna. eavesii-fulva. modesta—Parasemia plantaginis. petrosa—Parasemia plantaginis. nigra-fulva. tricolor-fulva. rufula-Diacrisia vagans. Leptarctia albida-Eustigmene. Noctua arge-Apantesis. albofascia-californiæ boisduvalii—californiæ fuliginosa-Phragmatobia. californica Walk. Parasemia plantaginis (Linn.) cinnamomea — Æmilia Phægoptera decia-californiæ dimidata-californiæ. roseata. quercus-Hemihyalea edwardsii. fulvo fasciata-californiæ. salacis-Halisidota maculata. lena-californiæ. Phalæna isabella-Isia. latifasciata—californiæ... Phobolosia reincarnata Dyar. Lerina incarnata (Walk.) Phragmatobia fuliginosa (Linn.) occidentalis-californiæ. vagans-Diacrisia. stretchii-californiæ. Leucarctia acræa-Eustigmene. Platyprepia virginalis (Boisd.) albida-Eustigmene. Pygarctia elegans (Stretch). californica-Isia isabella. Pygoctenucha terminalis Walk. Seirarctia clio-Euverna. isahella-Isia. permaculata—Turuptiana. Spilosoma vestalis-Haploa lecontei. maculata-Halisodota. Turuptiana permaculata Pack.

AGARISTIDÆ.

A family of day flying moths with dark wings on which are large white or yellow spots. Alypia octomaculata feeds on grape and ampelopsis and A. mariposa on the flower buds of Clarkia elegans.

SYNOPSIS OF GENERA.

Alypia. Pseudalypia: hind wings unspotted. Alypoides: hind tibiæ smooth scaled. Androlomia: costa swollen.

Agarista dispaci-Alypia. gutatta-Alypia. langtonii-Alypia.

lorquini—Androloma maccullochii.

mariposa-Alypia.

Alypia 1775 octomaculata. (65) 1864 ridingsii: (68) front tibiæ not orange. 1865 langtoni: (68) octomaculata—markings of hind wings yellow. 1868 mariposa: ridingsii-white markings traversed by black veins. dipsaci: langtoni-hind wing with yellow subdorsal spot.

Alypia brannari-Androloma. conjuncta-Androloma maccullochii. dipsaci G. & P.

gutatta (unidentified). langtonii Coup. lorquini-Androloma. mariposa (G. & R.). octomaculata (Fabr.).

ridingsii (Grote). sacarmenti-langtonii. similis-Androloma maccullochii Alypoides bimaculata (H.S.) Androloma brannani (Stretch.) maccullochii (Kirby). similis-maccullochii. Pseudalypia crotchii Edw. Zygena octomaculata-Alypia.

NOCTUIDÆ.

The largest family of the order, including the cut worms which are general

feeders. The moths have a series of markings uniform enough to be of great value in classification, and to have received a distinct nomenclature. A series of lines paralleling the outer margin are known as the subterminal, postmedian and antemedian abbreviated to st. pm. and am. lines. Just behind the base of the cell there is a dark streak often present, lying at right angles to the lines and known as the basal streak. There are also three spots known claviform just behind the cell, orbicular within the cell and reniform at the tip of cell; the names indicating their usual shape.

Monograph: Hampson Cat. Lep. Phal. British Mus. Vol.IV-

Abagrotis erratica-Triphæna.

Ablepharon absidum-Copablepharon.

Acerra addenda- Monima.

behrensiana—Xylomania. erythrolita--Xylomania. muricina (Oregon).

mys-Monima.

normalis-Perigrapha.

plusiiformis (Colorado). pulchella-Perigrapha.

transparens-Perigrapha.

areli-Tarache.

arizoniæ-Tarache elegantula.

behrii-Tarache. coquilletti-Tarache.

elegantula—Conochares. flavipennis—Tarache.

gonella Tarache.

lucasi Tarache.

Acronycta felina (Grote).

frigida Smith. hesperina Smith.

impleta Walk.

lepusculina (eastern).

mansueta Smith. .. marmorata Smith. othelia Smith. pacifica Smith. perdita Grote. quadrata Grote.

lupina-Merolonche.

lithospila Grote.

simplex-xylomania.

spinea-Merolonche.

Actinotia stewarti-Delta.

Aconitia angustipennis-Conaconia. Adelphagrotis apposita-Eurois. indeterminata-Eurois.

quarta-Eurois.

Admetovis oxymorus Grote. similis Barnes.

Adonisea languida-Heliothis pulchri-

pennis. pulchripennis-Heliothis.

Aedophron pallens Smith.

Agassizia urbicolor Behr.

Agriopodes viridata (Harv.). Agroperina cogitata (Walk.).

Agrophila tortricina Zell.

Agrotis 1776 ypsilon, 1880 havilæ: hind wings brown. The former a common cut worm.

Agrotis abnormalis-Tarachidia.

abnormis-Euxoa.

æneipennis-Feltia.

æqualis-Euxoa wilsonii.

agrostis-Euxoa. albipennis-Euxoa.

alticola—Euxoa.

annexa—Feltia.

apposita-Euxoa:

atomarius-Euxoa.

atrifera-Euxoa.

auxiliaris-Euxoa agretis.

bicollaris—Euxoa.

brevipennis—Euxoa.

brunneigera—Euxoa.

carissima-Triphæna.

catenula-Porosagrotis.

cicatrosa-Euxoa.

cinereicollis Grote. clandestina-havilæ.

clemens Smith.

cogitans-Euxoa choris colata-Euxoa.

costata-Triphæna.

crenulata-Triphæna.

cupidissima-Triphæna.

discoidalis-Triphæna. divergens-Euxoa.

erratica-Triphæna.

emarginata-Triphæna formalis.

euroides-Euxoa venusta.

evanidalis-Feltia.

excellens-Euxoa. pyrophiloides-Noctua. exsertistigmus-Triphæna. quadridentata-Euxoa. facula-Triphæna formalis. quarta-Eurois. fauna-Euxoa. quinquelinea-Euxoa. fenisica—Euxoa. formalis—Triphæna. radix-Polia. recula-Euxoa. friabilis-Euxoa. rema-Euxoa. furtivus-Euxoa. remota-Euxoa. rena-Euxoa. fuscigera—Euxoa. gagates-Euxoa. rosaria Grote. gravis-Feltia. rufipectus-Triphæna. havilæ Grote. satis-Euxoa. hollemani-Euxoa. segregata-Euxoa. incallida-Euxoa. sierræ How. incivis--Peridromia. serricornis-Euxoa. inelegans-Triphæna silens-Euxoa. infimatis-Anomogyna. specialis-Euxoa wilsoni. infelix-Euxoa excellens. spectranda-Euxoa verticalis. innotabilis-Eurois indetermintesselloides-Euxoa. ata. vaucouverensis-Feltia. insignata-Euxoa. variata-Triphæna. intrita—Euxoa. venerabilis-Feltia. introferens-Euxoa auxiliaris. verticalis-Euxoa. lacunosa—Euxoa. vorax-Homoncocnemis fortis. lætula-Triphæna. vernalis-Anomogyna. volubilis—Feltia. wilsoni—Euxoa. lagena-Euxoa. lutulenta—Euxoa. malefida-Feltia. ypsilon Rott. mercenaria --- Euxoa agrestis. Amathus bicolorago (Guen.) messoria-Euxoa. fornica (Smith). micronyx-Euxoa. purpurea (Grote). milleri-Feltia. Amphipyra glabella (Morr.) mimallonis-Porosagrotis. pyramidoides Guen. nostra-Euxoa. Anarta kelloggi-Symphistis. observabilis-Triphæna exsertimimuli Behr. stigma. Andropolia maxima (Dyar.) orbis--Triphæna variata. olorian (Grote). oblata Morr. theodora (Grote). germana Edw. Annaphila amicula-decia. lithosina Edw. arvalis Edw. mera Harv. aurantiaca-Incita. miona Smith. danistica Grote. salicis arvalis. casta Edw. superba Edw. decia Grote. oblongistigma-Euxoa. depicta Grote. pallidicollis-cinereicollis. diva Grote. perfusca-Euxoa. divinula Edw. plagigera-Euxoa. domina Edw. punctigera-Euxoa.

Anomogyna 1879 vernilis. 1880 infimitalis: front wings tinged with rufus.

Anomogyna infimatis (Grote.) vernilis (Grote).

Anytus 1857 privata. 1888 evelina: front wings dark. The latter feeds on Lupines and Ribes.

Anytus evalina (French.) privata (Walk.). sculptus-privata. Apamea cogitata-Agroperina. lunata Smith. nictitans (Linn.). Apatela felina-Acronycta. frigida-Acronycta. hesperida-Acronycta. impleta-Acronycta. lepusculina (eastern) lupina-Merolonche. mansueta-Acronycta. marmorata—Acronycta. pacifica-Acronycta. perdita-Acronycta. quadrata-Acronycta. spinea-Merolonche. theodori-Andropolia. Aporophila yosemitæ Grote. Archenaria alameda (Smith.) Arisolonche albovenossa (Goez.) Arthrochlora feburalis-Monophana. Aspila subflexa-Chloridia virescens. Athetis drasteroides (Smith.) Atethmia canescens-Calymnia orina. Auchmis confusa-Morrisonia. Autographa albavitta Ott. biloba Steph. brassica (Ril.). falcigera Kirby. gamma (Linn.). labrosa (Grote). ou (Guen.). pasiphæia Grote. Axenus amplus— arvalis. arvalis (Grote). ochraceus- arvalis. Balsa albopunctella Walk. Behrensia conchiformis Grote. Bolina cinis (undetermined.) hadeniformis (unidentified). jucunde (unidentified). Bombycia curvifascia (Smith.) elda (French.) Bombyx odora-Erebus. Bomolocha incusalis-Pleonectyptera. Brachylomia rectifascia (Smith.) Bryomima fallax (Smith.)

Bryophila fascia (Smith.)

Cabaloides franciscana (Smith.) Cabalos franciscanus-Cabaloides. Cænurgia adversa (Grote.) Calymnia orina (Guen.) Capnodes californica Behr. Caradrina drasteroides-Athetis. exigua Huebn. extimia Athetis. flavimacula—Laphygma. glabella---Amphipyra. leucorena Namangana. miranda Proxenus. Carneades-Euxoa. Catocala adromache Edw. adulterata (not authentic). aholibah Stretch. aspasia Stretch. augusta-aspasia. californica Edw. cleopatra-californica. electilis-californica. faustina Stretch. francesca-mariana. fratercula G & R. hermia Edw. hippolytia Edw. ilia (Cram). irene-californica. jessica Edw. junctura (eastern). mariana Edw. marmorata Edw. perdita-faustina. portia-stretchii. relicta Walk. stretchii Behr. verilliana Grote. virgilia-irene. volumina-irene. zoe-ilia. Cea cirphidia Ham. Cerapoda oblita (Grote.) C læna contrahens-Eriopyge. Cerma fascia-Bryophila. olivacea Sm. Chabulata fistula (Harv.) Charadra decora Morr. extimia Walk. miranda Grote. Cheophora blanda-Mythimna.

viridata—Agriopodes.

Chloridea 1781 virescens. 1827 armigera: front wings without oblique am.
m. and pm. lines. 1867 phloxiphaga: hind wings with large black discoidal spot. The corn worm, armigera, is a great pest on sweet corn and tomatoes

virescens feeds on solenaceæ and phloxiphaga on Grindelia.

Chloridea armigera (Hueb.)
phloxiphaga (G. & R.).
subflexa virescens.
virescens Fabr.

Chorizagrotis agrestis—Euxoa.
auxiliaris—Euxoa.
introferens—Euxoa auxiliaris.
Chytonix parvimacula Smith.

Cirphis 1809 unipuncta. 1852 insueta (79 81) no white spot at lower angle of cell. 1879 dia: insueta—front wings not tinged with red. 1881 farcta: (02) insueta—abdomen not reddish beneath. 1902 palliseca: farcta—blackish bands on tibial spur. C. unicolor is the army worm, perhaps the most injurious member of the family. Feeds largely on alfalfa, often migrates into vineyards after cutting.

Cirphis dia. (Grote.)
farcta (Grote).
insueta (Guen.)
palliseca (Smith).
Cirrhobolina mexicana (Edw.)
tetrica (Edw.).
Cissura biformata (Edw.)
scropulosa (Edw.)

subtermina (Sm.). Cleoceris curvifascia—Bombycia. alda—Bombycia.

rectifascia—Brachylomia. Cleophana eulepis—Copicucullia.

occata—Oncocnemis Cobaloides angelicus Smith. franciscanus Smith.

Conacontia angustipennis (Grote.) Conochares altera (Smith.)

elegantula (Harv.). interrupta Smith. blephron absidium (

Copablephron absidium (Harv.)
Copibryophila angelica Smith.
Copicucullia eulepis (Grote.)
Cosmia orina—Calypinia.

sambuci—Zotheca tranquila. Cradrina drasteroides—Athetis..

Cucullia serraticornis Lint.
solidaginis Behr.
Cyathissa pallida—Emarginea.
Dargidia procinctus—Hadena.
Delta stewarti (Grote.)
Deva palligera—Panchrysa.
Dianthæcia insolens—Polia.
leucogramma—Polia.
refula—Eriopyge.
Dicestra chartarina (Grote).
Dicopis damnalis—Eutolype.
Drasteria cærulea Grote.

Crimona pallimedia Smith.

Dicopis damnalis—Eutolype.
Drasteria cærulea Grote.
Dryobata apina—Dryotype.
curvifascia—Bombycia.
elda—Bombycia.

rectifascia—Brachylomia.
Dryotype apina (Grote.)
Dysocnemis prorupta (Grote.)
oregonica (Edw.).

Emarginea pallida (Śmith.) Epia minorata (Śmith.) Epizeuxis (Jubicalis (Geyer.)

Erebus odora (Linn.)
Eremobia unicincta (Smith.)

Eriopyge 1860 contrahens. (87) 1874 puerilis: front wings tinged with purplish red. rufula: front wings purplish red. 1879 perbrunnea: rufula—orbicuvery indistinct. 1887 irrorata: male with long downturned hair on under side of front wings. 1890 curta: antennæ of male bipectinate. 1905 affructa: pm. line outcurved to vein 4 and then incurved.

Eriopyge affructa Ham.
contrahens (Walk.).
curtica (Smith).
irorata (Smith).
perbrunnea (Grote).
puerilis (Grote).
rufula (Grote).

Eudryas brevipennis Stretch.
Euharveya carbonaria Harv.
Euherrichia cervina—Protophana.
Eumestleta carmelita Morr.
daria (Druce).
Euplexia lucipara (Linn.)
Eupsephopæctes procinctus—Hadena.

Eurois 1865 indeterminata. 1878 apposita: front wings without black basal streak.

Eurois apposita (Grote.)
indeterminata (Walk.).
pluviosa—Parastichtis arctica.
quarta (Grote.)
Euros proprius—Symphistis.

Euthisanotia brevipennis—Eudryas.
Eutolype dramalis (Grote.)
perscripta—Lepipolis.
Eutricopsis naxilis Morr.

penita—includens.

Eustrotia includens (Walk.)

Euxoa 1841 messoria. (65 74 75 78) 1856 insignata: (74 75 90) front wings not densely irrorate with dark. divergens: (65 78 90 91 00) front wings with cell dark between stigmata.

1865 vetusta: (76) divergens— front without black basal dash. septentrionalis: messoria—front wings with well defined series of dark dentate marks before st. line. punctigera: (74 75 83 87 90) messoria— front wings without median shade. quadridentata: (74 76) veins 3, 4, 6 and 7 of front wings defined by pale streaks strongly indenting the st. line. cicatrosa: quadridentata— front wings with stigma and submedian fascia clear yellow.

1873 auxillaris: antennæ of male not strongly serrate and fasciculate.

1874 fuscigera: insignata—hind wings not wholly tinged with brown. intrita (75) messoria— front wings dark brown. hollemani (78) punctigera—tegulæ with prominent median band or shade. plagigera (87) quadridentata hind wings wholly suffused with brown.

1875 brunnigera (90) insignata—orbicular and reniform without dark centers. friabilis: intrita—hind wings almost entirely white in the male. fenipunctigera—front wings reddish brown.

1876 satis: (77 80 81 90) vetusta—hind wings entirely suffused with brown. fauna: insignata—front wings with lines indistinct. recula: quadridentata: orbicular v-shaped, open above.

1877 albipennis: satis—hind wing of male white with brown terminal line, of female wholly suffused with brown.

1878 atrifera: (80) divergens—hind wing of male whitish, terminal area suffused with brown. micronyx (90) messoria—hind wings nearly entirely suffused with brown. bicollaris: (00) hollemani—orbocular and reniform not confluent

1880 tesselloides (00) atrifera—ground color of front wings grey. verticalis: satis—hind wings of both sexes white, terminal areas tinged with brown.

1881 collata: (00) satis—orbicular open above,

1883 perfusca: punctigera—stigmata defined by blackish.

1887 serricornis: punctigera—front wings rufus, without dark irrorations. oblongistigma: plagigera—front wings with cell suffused with black. brevipennis (94) quadridentata—orbicular oblong.

1890 furtiva: (00) divergens—orbicular v-shaped. intrusa: satis—front wings with cell prominently black. nostra: satis—front wing with terminal area blackish. rena: satis—no dark band on tegula. incallida: brunnigera—front wings brownish grey. lutulenta: insignata—median shade prominent. quinquelineata: micronyx—claviform not well defined. remota: (00) punctigera—front wings with ground color grey.

1891 fusimacula: divergens—front wings with reniform confluent or nearly so with orbicular.

1894 segregata: brevipennis—front wings tinged with reddish brown.

1900 compressipennis: divergens—ground color of front wings reddish brown. Cæsia: divergens—no white streak on median veiu of front wing. silenis: tesselloides—lines about obsolete. laminis: tesselloides—tegulæ rufus at base. vanidica: furtiva—front wing with oblique yellow streakfrom end of claviform. noctuiformis: collata—front wings brown. tocoyæ: feniseca—front wings yellow suffused with brick red. relaxa: feniseca—front wings pale fuscous tinged with rufous. nævula: remota—front wings without rufous tint. fulda: nævula—front wing with terminal area dark. loya: bicollaris—front wings not brown. nevada: hollenmani—front wings with costal area concolorous.

Euxoa abnormis (Smith.) acutifrons (Smith), agrestis (Grote). albipennis (Grote). alticola (Smith). atomaris (Smith). atrifer Grote auxiliaris (Grote). bicollaris Grote. bifirmata Smith. brevipennis (Smith). brunniegera (Grote). cæcius (Smith). choris (Smith). cicatrosa (Grote). cinereopallida Smith. cogitans (Smith). colata Grote. compressipennis (Smith). divergens (Walk.). excellens (Grote). fauna (Morr.). feniseca (Harv.). flutea Smith. friabilis (Grote). fulda (Smith). furtiva (Smith). fuscigera Grote. fusimacula Smith. gagates (Grote). henrietta (Smith). hollemani (Grote). incallida (Smith). incubita (Smith). insignata (Walk.). insulsa—messoria. intrita Mor.

intrusa (Smith). lacunosa (Grote). lagena (Grote). laminis (Smith). loya (Smith). lutulenta (Smith). messoria (Harr.). micronyx (Grote). nævula (Smith). nevada (Smith). noctuiformis (Smith). nostra (Smith). oblongistigma (Smith). perexcellens-excellens. perfusca (Grote). plagigera (Morr.). punctigera Walk. quadridentata (G. & R.) quinquelinea (Smith). recula (Harv.). relaxus (Smith). remota (Smith). rena (Smith). satis Harv. segregata (Smith). selenis (Smith) septentrionalis (Walk.). serricornis (Smith). silens Grote. spectanda-verticalis. tesselloides Grote. tocoyæ (Smith). vanidica (Smith). verticalis (Grote). vestuta Walk. wilsonii (Grote). Fala phycophora Grote.

Feltia 1825 annexa. (73 78) 1852 maleflda: (56) claviform filled in with

black. 1856 venerabilis: malefida—hind wings brown. 1873 vancouverensis: (74 75) annexa—hind wings brown. 1874 gravis: vancouverensis— head dark. volubilis: (76)vancouverensis—lines indistinct. 1875 milleri: vancouverensis—head not ferruginous. 1876 æneipennis: volubilis—front wings without dark streak beyond the reniform. 1878 evanidalis: annexa—orbicular v-shaped

Feltia æneipennis (Grote.) annexa (Triet.). evanidalis (Grote). gravis (Grote). malefida (Guen.). milleri (Grote). vancouverensis (Grote). venerabilis (Walk.). volubilis (Harv.). Feralia feburalis-Moniphana. Fruva acerba-Tarache. modesta Edw. Galgula partita Guen. Glæa olivata-Psectraglæa Gortyna albilunata-Apamea lunata. nictitans-Apamea. obliqua-Hydrœcia. sawzalltæ-Ochria. Græparia megocula (Smith.) Graphiphora arthrolita-Monima. behrensiana—Xylomania. curtica-Eriopyge. erythrolita-Xylomania. furfurata-Eriopyge affurata. muricina (Colorado). normalis-Perigrapha. pacifica-Monima. pectinata-Perigrapha. perbrunnea-Eriopyge. præses-Perigrapha. puerilis-Eriopyge. pulchella-Perigrapha. rubica-Xylomania. terminata-Perigrapha. Graptolita contenta (Grote.) dilatocula (Smith). gausapata (Grote). oregonensis (Harv.) puella (Smith). Gyros muirii (Edw.) Hadena adnixa-Tarache. albina-Parasticta. antennata-Parastichtis. binotata-Trachea. castanea-Parastichtis arctica. catalina—Tarache. centralis—Trachea. cinefacta—Trachea.

cogitata-Agroperina.

cuculiformis-Parastichtis.

curvata—Trachea binotata. cymosa—Porastichtis castanea. devastatrix-Sidemia. didonea—Xylomania. divesta—Trachea. evelina—Anytus. ethnica—Trachea. fumcola—Trachea. genetrix-Trachea. genialis-Parastichtis. glorina-Polia. inconspicua-Trachea paviæ. indirecta—Trachea. lævigata—Oligia. mariana—Trachea. mustelina-Trachea. occidens—Parastichtis. olorina-Andropolia. pausis-Trachea. pavia-Trachea. pluviosa-Parastichtis arctica. procincta (Grote). rectifascia-Cleoceris. relicina-Parastichtis. stricta-Polia. susquesa-Trachea. tusa-Trachea. unicnicta-Eremobia. violacea-Oligia. Hecatera laudabilis-Polia. Hagena cuculliformis-Parastichtis. Helia occidentalis-Epizreuxis lubricalis. Heliaca diminutiva-Heliothodes. nexilis-Eutricopsis. ranunculi-Xanthothrix. Heliodes angelica Smith. restrictalis-Microhelia. Heliosea pictipennis Grote. Heliolonche modicella Grote. Heliophana amarylis Smith. Heliophila dia.-Cirphis. farcta-Cirphis. heteradoxa-Cirphis insueta. megadia—Cirphis dia. minorata—Leucania. oxygale-Leucania. palliseca-Cirphis.

unipuncta-Cirphis.

Heliosea pictipennis (Grote.)

Heliothis armiger-Chloridia. figurata Oncocnemis. fortis-Homococnemis. californica-sueta. picina-Homococnemis fortis. celeris (Grote). Homoncocnemis fortis (Grote.) erotchii-Schinia cupes. diminutiva—Heliothodes. Homoptera salicis-PHæcyma. græfiana (Tep.) rosæ-Phæcyma salicis. rubi-Phæcyma. lanul-Schinia. Hoplolythra discistriga (Smith.) pulchripennis (Grote). phlogophagus-Chloridia phlox- Hydrœcia albilunata-Apamea lunata. angelica—Papaipema. lunata-Apamea. proruptus-Dysocnemis. obliqua (Harv.). sueta (Grote). vacciniæ (Edw.) pacifica-Apamea nictitans. villosa (Grote). Hypena californica Behr. Heliothodes diminutivus (Grote.) decorata—californica. modesta Smith. fasciata (Edw.). Herrichia cervina-Protophana. Hyssia niveoguttata (Grote.) Heterogramma palligera—Tetanolita. incita aurantiacus (Edw.) Himella furfurata—Eriopyge affurata. Ingura cristatrix-Pæctes. Homoglæa californica (Smith. declinata-Pœctes. carbonaria (Harv.). Jaspidia viridata-Agriopodes. Homobadena chorda—Oncocnemis. Laphrygma flavimaculata Harv. deserta-Litocala sexsignata. Lepipolys perscripta Guen. behrensi (Grote). elda—Bombycia. Lasionycta 1879 arietis. 1880 defessa: claviform well developed. Lasionycta arietis (Grote.) minorata Smith. oxygata (Grote.) ochracea (Grote). Leucania dia-Cirphis. pallens (Linn.). farcta-Cirphis. unipuncta-Cirphis. henrici-Simyra. Leucanitis adumbrata—Syneda. heterodoca—Cirphis insueta. Leucania 1758 pallens. 1881 oxygala: hind wings uniformly tinged with fuscous. 1894 minorata: front wing with fuscous shade below median vein. Perigonica 1890 angulata. 1902 tertia: male antennæ bipectinate. Lithophane carbonaria-Homoglæa. edwardsii-Syneda. maculosa-Syneda. contenta-Graptolitha. gausapata-Graptolitha. nubicula-Syneda. oregonensis-Graptolitha. ochracea-Syneda. stretchii-Syneda howlandii. Lithocala sexsignata Harv. socia-Syneda. Litosea agversa—Cœnurgia. Luperina posticata (Harv.) tejonica-Syneda. Litholomia napæa (Morr.) Lycophonta 1809 margarintosa. 1852 lubricans: (03) reniform small. 1903 radiola: lubricans-front wings not reddish. Lycophontia lubricans (Guen.) radiola Ham. margaritosa (Harv.) Lygranthœcia 1864 mortua. 1893 intrabilis: hind wings orange.

anetis-Lasionycta.

binotata-Trachea.

chartaria-Discestra.

cinnebarina-Polia stricta.

circumcineta-Polia stricta.

Lygranthæcia intrabilis (Smith.)

Lythrodes discistriga—Hoplolythra.

mortua (Grote).

Mamestra albogutta-Polia.

saturata-Schinia.

comis-Polia olivacea. crotchii-Polia. cuneata-Polia. davena-Polia olivacea. defessa-Scotogramma. dimmocki-Polia radix. discalis-Polia. incolens-Polia. insulsa-Euxoa messoria. sueta. invalida-Polia. laudabilis-Polia. lepidula-Polia. leucogramma-Polia. minorata-Epia. nevadæ-Polia. niveiguttata—Hyssia. noverca—Polia. olivacea—Polia. passa-Polia. pensilis-Polia. puerilis-Eriopyge. punctigera-Euxoa. quadrata-Polia. quadrillineata-Polia radix-Polia. rectilinea-Polia olivacea. rubrica-Xylomania. septentrionalis-Euxoa. stricta-Polia. subapicalis—Xylomania perlub-

trifolii-Scotogramma. unipuncta-Cirphis. u-scripta—Trichoclea. ventusta-Euxoa. vicina-Polia. Melanoporphyria prorupta Grote. Melichleptria californiensis-Heliothis celeris-Heliothis. fasciata-Heliothodes. oregonica-Dysocnemis. græfiana-Heliothis. perminuta-Pseudotamilia. prorupta-Melanoporphyria. pulchripennis-Heliothis. sueta-Heliothis. vacciniæ-Heliothis. villosa-Heliothis. Meliopotis bolino-jucunda. cinis-jucunda. hadeniformis-jucunda. jucunda (Hubn.). Merolonche lupina (Grote). ursina S. & D. spinea (Grote). Metalepsis cornuta (Grote). Microhelia restrictalis (Smith). Miodera stigmata Smith.

Monima 1820 addenda. 1874 arthrolita: male antennæ fasciculate. pacifica: arthrolita—st. line pale. 1902 nys: male antennæ bipectinate.

Monima addenda (Smith).
 arthrolita (Harv.).
 mys (Dyar).
 pacifica (Harv.).
Monophana februalis (Grote.)
Morrisonia confusa (Hubn.).
 peractua Morr.
Mythimna blanda (Grote).
Namangana alfceni (Grote).
 leucorena (Smith).
Nephelodes mimians Guen.
Nocloca nesæa (Smith)
 rivulosa Smith.
Noctua armigera—Chloridia.

Noctua armigera—Chloridia.
albovenosa—Arsilonche.
clemens—Agrotis.
gamma—Autographa.
havilæ—Agrotis.
lucipara—Euxplexia.
lubricans—Lycophotia.
margaritosa—Lycophotia.
nictitans—Apamea.
oblata—Agrotis.

le antennæ laselculate.

odora—Erebus.
pallens—Leucania.
pallidicornis—Agrotis cinnereicollis.
pyrophiloides Harv.
rosaria—Agrotis.
saucia—Peridromia.
virescens—Chloridea.
sierræ—Agrotis.
Nonagria alameda—Archenaria.
Ochria sauzælitæ Grote.
Oligia lævigata (Smith).
violacea (Grote).
Omia nesæa—Nocloa.

Oncocnemis albifasciatus Ham.
aqualis (Grote).
aterrima—Pseudocontia.
angustata Harv.
behrensi—Lepipolis.
chorda (Grote).
corusca Smith.
exemplaris (Smith).
fasciatus—albifasciatus.

cornuta-Metalepsis. figurata Ham. fortis-Homoncocnemis. Pæctes cristatrix (Guen.). fragmantis Smith. declinata (Grote). Palada scarletina Smith. gracillinea—Oxycnemis. Panthea portlandia Grote. hayesi Grote. major Grote. Panchrysa palligera (Grote). menantho Smith. Papaipema angelica (Smith). Paragrotis (Euxoa). mirificalis Grote. Parastichtis albina (Grote). oblita-Cerapoda. antennata (Smith). occata (Grote). arctica (Boisd.). pophono Smith. Orrhodia californica-Homoglæa. castanea (Grote). cuculliformis (Grote). irrorata-Eriopyge. genialis (Grote). Orthodes puerilis-Eriopyge. Orthosia bicolorago-Amathes. occidens (Grote). relicina (Morr.). formica-Amathes. hamifera-Perigrapha transpar Peridromia demutabilis (Smith). incivis (Guen.). ens. posticata-Luperina. purpurea-Amathes. Oxycnesis fusimacula (Smith). gracillinea (Grote). yuma-gracillinea. Pachnobia cinerascens (Smith).

saucia (Hubn.). Perigea alfkenii-Namangana. falsa-Bryomima. mersa (Morr.). Perigonica angulata Smith. tertia Dy r. Perigrapha 1876 pulchella (87) 1879 præses (81) antennæ of male fasciculate. 1881 transparens: præses-inner margin of front wing crimson. 1887 terminata: pulchella-orbicular absent. pectinata: terminata-postmedian area of front wings concolorous. 1891 prima: antennæ bipectinate in both sexes.

1894 normalis: reniform and orbicular confluent. Perigrapha behrensiana-Xylomania. Phobolosia resincarineta Dyar. inferior—Stretchia. muricina (Oregon). normalis (Grote). pectinata (Smith). præses (Grote). prima Smith. pulchella Harv. terminata (Smith). transparens (Grote). Phæcocyma salacis (Behr.). tertia Dyer. Phalæna devastatrix—Sidemia. Phalæna devastatrix—Sidemia. Phæcocyma salacis (Behr.)

rosæ-salacis. rubi (Edw.). Phoberia indiscreta (Edw.).

ilia-Catocala.

Pleonectopoda—Euxoa. Pleonectyptera finitima Smith. incusalis Grote secundatis Grote. subflavidalis Grote. Pleroma cinerea Smith. obliquata Smith. Pleuronectyptera finitima Smith. Plusia brassica-Autographa. californica-Autographa gamma. gamma-Autographa. labrosa-Autographa. lenzi-metallica.

metallica Grote.

ou-Autographa. russea-Autographa gramma. Podagra crassipes Smith

Polia 1852 laudibilis. (65 73) 1856 radix: (91) st. line dentate on veins 3 and 4 forming a distinct w-mark.

1865 stricta: (74) laudabilis—front wing with tip of median vein streaked with white.

1873 quadrilineata (77) laudabilis—ground color of front wings grey white. cuneata: (74 93) laudabilis—reniform large, kidney-shaped. leucogramma: (74 77 87) antennæ of nale fasciculate.

1874 olivacea: stricta—front wings not reddish brown. pensilis: (05) claviform extending well below the cell. passa (76) prothorax with a divided crest. insolens: (05) leucogramma—front wing not reddish.

1876 nevadæ: (00) passa—front wings with distinct w-mark.

1877 alboguttata: quadrilineata—am. and pm lines not approximate behind. discalis (50) leucogramma—prothorax with divided crest.

1878 noverica: vicina-reniform U-shaped.

1880 crotchi: discalis-front wings tinged with brown.

1887 lepidula: leucogramma—pm.line incurved below vein five.

1891 quadrata: radix—front front wings without black basal streak.

1893 densa: cuneata-ground color of front wings yellowish brown.

1900 invalida: nevadæ—front wings with am. and pm. lines conjoined by a black streak in submedian fold.

1905 stenotis: pensilis—ground color of front wings white. canites: insolens—ground color of front wings yellowish brown.

Polia alboguttata (Grote).
canites Ham.
crotchii (Grote).
cuneata (Smith).
densa (Smith).
dicalis (Grote).
insolens (Grote).
invalida (Smith).
laudabilis (Guen.).
lepidula (Smith).
leucogramma (Grote).
maxima—Andropolia.
nevadæ (Grote).

olivacea (Morr.).
olorina—Andropolia
passa (Morr.).
pensilis (Grote).
privata—Anytus.
quadrata (Smith).
quadrilinea (Grote).
radix (Walk.).
stenotis Ham.
stricta (Walk.)
theodori—Andropolia.
vicina (Grote).
Polia olorina (Grote).

Porosagrotis 1873 mimallonis. 1879 catenula: pm. line reduced to a series of spots.

Porosagratis catenula (Grote).
milleri Feltia.
mimallonis (Grote).

noverica (Grote).

Pronoctua pyrophiloides Harv.
Prodenia ornithogali Guen.
præfica Grote.

Protophana cervina (Edw.).

Pseudotamilia 1798 vanella. 1881 perminuta: no antemedian whitish band on hind wings.

Pseudotamila perminuta Edw.
vanella Grote.
Pyrocleptria californica Ham.
Pyrophila glabella—Amphipyra.
Pyrrhia umbria Hubn.

Rancora matricaria—Cucullia serraticornis.

Proxenus miranda (Grote)
Psectraglæa olivata (Harv.).
Pseudoglæa blanda—Mythimna.
Pseudoglossa decepta—Mythimna
blanda.
Pseudoglossa lubricalis—Epizeuxls.
Pseudorthosia variabilis Grote.

solidaginis—Cucullia.
Raphia cinderella Smith.
coloradensis Put.
pallula—coloradensis.
Rhizagrotis abnormis (Smith).
lagena (Grote).
Rhodosia julia—Timora.

hastingsii Edw. howlandii Grote.

Rhynchagrotis (Triphæna). formalis (Grote). Rhynchagrotis carissima (Harv.). inelegans (Smith). lætula (Grote). costata (Grote). rufipectus (Morr.). crenulata (Smith). cupidissima (Grote). trigona Smith. variata Grote. exsertistigma (Morr.). Schinia 1852 arcigera, 1874 saturata: ground color of hind wings white. 1875 cupes: (77) saturata—front wings yellowish white. 1877 lanul: cupes markings of front wings not reddish. ochreifuascia-lanul. Schinia arctifera Guen. buta Smith. packardii-Lygranthecia mortua saturata (Grote). velaris—lanul. cupes (Grote). intrabilis—Lygranthœcia. Scoliopteryx libatrix (Linn.) Janul Str. ligeæ—Thyreion. Scopelosoma napæa-Litholomia. Scotogramma 1776 trifolii. 1880 defessa: no distinct w-mark on st. line. Former species feeds on Chenopodium and Atriplex. Scotogramma defessa (Grote). macculosa Behr. densa-Polia. mexicana-Cirrhobolina. trifolii (Rot.) nubicola Behr. Segetia mersa-Perigea. ochracea Behr. Setagrotis dernarius Smith. perpallida-hastingsii. socia Behr. infimatis—Anomogyna. radiatus-Lycophotia radiola. stretchii—howlandii. Sidemia devastatrix Brace. tejonica Behr. Simvra henrici (Grote). Tæniocampa addenda-Monima. Sprogueia fumata—Tarachidia. arthrolita-Graphiphora. vernalis-Anomogyna. carina-Polia insolens. Stibadium fulignosa Stiria. curtica-Eriopyge furfurata—Eriopyge affurata. hutsoni-Stiria. Stiria fulignosa (Smith). pacifica-Monima. hutsoni (Smith). Tænicampi paviæ-Trachea. Stretchia addenda-Monima. pectinata-Perigrapha. behrensiana—Xylomania. perbrunea-Eriopyge. erythrolita—Xylomania præses-Perigrapha. inferior (Smith). puerilis-Eriopyge. normalis-Perigrapha pulchella-Perigrapha. mys-Monima. rufula-Eriopyge. plusiiformis (Colorado). terminata-Perigrapha. Tamila vanella-Pseudotamila. pulchella-Perigrapha. transparens-Perigrapha. velaris-Schinia lanul. Stylopoda cephalica Smith. Tarache angustipennis-Conacontia. Symphistis kelloggi (Edw.). acerba (Edw.). propius Edw. areli (Stretch). Synedoida biformata-Cissura. behrii (Smith). scrupulosa-Cissura. candefacta-Tarachidia. subtermina—Cissura. coquilletti (Smith). Syneda adumbrata Behr. elegantula-Conochares. divergens Behr. flavipennis (Grote). edwardsii Behr. gonella (Stretch). hadeniformis-Melipotis iucunlucasi (Smith). da. niveicollis Smith.

semiopaca-Conochares elegant-

```
Trachea adnixa (Grote).
        ula.
Tarachidia candefacta (Hubn.).
                                            binotata (Walk.).
     fumata (Smith).
                                             catalina (Smith).
      tortricina (Zell.).
                                             centralis (Smith).
Tetanolita palligera (Smith).
                                             cinefacta (Grote.)
Thalpocharea arizonæ-Conochares el-
                                             divesta (Grote).
    egantula.
                                             ethnica (Smith).
     elegantula-Conochares.
                                             fumeola Ham.
     daria-Eumestleta.
                                             genetrix (Grote).
Therasea angustipennis-Conacontia.
                                             indirecta (Grote).
Thyreion ligeæ (Smith).
                                             marina (Grote).
Timora julia (Grote).
                                            mustelina (Smith).
Tornacontia altera—Conochares.
                                             pausis (Smith).
Tornacontia megocula-Græperia.
                                            tusa (Grote).
      paviæ (Behr.).
  Trichoclea 1887 edwardsi. 1871 antica: terminal band of hind wing no deep
fuscous. U-scripta: am. line absent.
                                             cupidissima Grote.
Trichoclea antica Smith.
     edwardsii Smith.
                                             discoidalis (Grote).
                                             exsertistigma (Morr.)
     postica (Colorado).
     u-scripta (Smith).
                                             erratica (Smith).
Tricholita fistula-Chabultat.
                                             formalis (Grote).
Trichosellus cupes Grote.
                                             inelegans (Smith).
Trichotarche assimilis Grote
                                             lætula (Grote).
                                             meta (Smith).
Triocnemis saporis Grote.
Triphæna carissima (Harv.).
                                             rufipectus (Morr.).
     costata (Grote).
                                             variata (Grote).
     crenulata (Smith).
                                       Tristyla alboplagiata Grote.
  Ufeus 1873 plicata. 1883 sagitaria: lines obsolete.
Ufeus plicatus Grote.
                                             curialis (Grote).
     sagittarius Grote.
                                             hiemalis (Grote).
Ulolonche niveiguttata-Hyssia.
                                            patelis (Grote).
Veleria opina Grote.
                                            perlubens (Grote).
Xanthia bicoloraga- Amathes.
                                            rubrica (Harv.).
     palæcea Eesp.
                                            simplex (Walk.).
Xanthothrix neumægeni Edw.
                                       Xylomiges cruciles-Xylomania sim-
     ranunculi Edw.
                                           plex.
Xylina amanda Smith.
                                             curialis-Xylomania.
                                            hiemalis-Xylomania.
     carbonaria (Harv.).
     contenta-Graptolitha.
                                            ochracea-Lasionycta
     dilatocula-Graptolitha.
                                            patalis-Xylomania.
     indeterminata-Eurosis.
                                            perlubens-Xylomania.
     infructosa-Morrisonia confusa...
                                            rubrica-Xylomania.
     oregonensis-Graptolitha.
                                            simplex-Xylomania
     torrida Smith.
                                       Xylomæa didonea (Smith).
Xylomania behrensiana (Grote).
```

Xylomania 1865 simplex. 1873 curialis: antennæ of male fasciculatel patalis: antennæ of male ciliated. 1874 hiemalis: (75) antennæ of male bipectinate. 1875 behrensiana: hiemalis—orbicular and reniform confluent. 1878 rubrica: (81) simplex—front wings with ground color brownish grey. 1881 perlubens: rubrica—front wings without black basal streak.

Xylophasia albina—Parastichtis antennata—Parastichtis.

centralis—Trachea. cinefacta—Trachea.

cogitata—Agroperina. cuculiformis—Parastichtis. genialis—Parastichtis. occidens—Parastichtis. pluviosa—Parastichtis arctica Yrias crudelis Grote. Zosteropoda hirtipes Grote. Zotheca tranquila Grote. viridula—tranquila.

NYCTEOLIDÆ.

A small family represented in California by a single species. Nycteola revanyana Scop.

PERICOPIDÆ.

A Mexican species extends into southern California.

Gnophaela hopfferi—latipennis. latipennis Boisd.

DIOPTIDÆ.

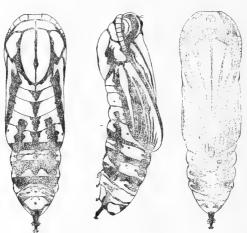


Figure 24. Pupa of the oak moth.

The oak moth is very troublesome in the bay region completely defoliating the live oaks every few years. It would not be very difficult to control by spraying with lead arsenate if the trees were smaller.

Phryganidia californica Pack.

NOTODONTIDÆ.

Two moths of considerable importance belong to this family, Datana ministra which feed gregariously on walnut, and Schizura concinna, the redhumped caterpillar of the apple.

Alastor gibbosa—Nadata. Cerura cinerea—Harpyia.

cinereoides—Harpyia. paradoxa—Harpyia cinerea. Ccolepandra—Harpyia. Clostera incarcerata—Melalopha apicalis.

Coelodasys conspecta—Schizura unicornis.

Datana californica Riley

ministra Drury. Dicranura scolopendrina-Harpyia. Drymonia dimidiata-Pheosia. Eumelia severa—Gluphisia. Gluphisia albofascia wrightii. crenata-septentrionalis. septentrionalis Walk. severa Edw. wrightii Edw. Harpyia cinerea (Walk.). scolopendrina (Boisd.). Hyperaeschra strangula (Grote).

Ichthpura apicalis-Melalopha. bifiria-Melalopha. brucei-Melalpha. incarcarata-Melalopha apicalis. Notodonta californica-Pheosia diminornata-Melalopha. ornata-Melalopha apicalis.

Melalopha apicalis Walk. alethe—brucei. brucei Edw. inornata Neum.

multonoma-brucei. Melia danbyi-Gluphisa severa. Phalæna concinna-Schizura. gibbosa-Natdata. unicornis-Schizura. Pheosia californica-dimidiata. dimidiata H. S.

portlandia Edw. Schizura concinna S. & A. conspecta-unicornis. ipomoeæ Doub.

unicornis S. & A. Nadata behrensii-gibbosa. gibbosa (S. & A.). oregonensis-gibbosa.

> idiata. pacifica-Hyperæschra strangu-

strangula-Hyperæschra. Oedemasia salacis—Schizura concinna unicornis-Schizura.

THYATIRIDÆ.

Bombycia improvisa Edw. Gluphisia tearlei-Bombycia improvisa tearlei-improvisa.

LIPARIDÆ.

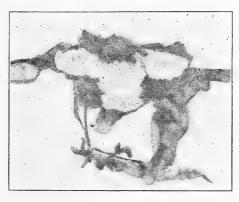


Figure 25. Cocoons of tussock moth with egg masses.

THis family is represented here by a single species.

The tussock moth of this coast resembles the eastern species quite closely but is very much more resistant to arsenicals requiring very heavy doses. or the use of some of the other methods described in Cal. Bulletin 183.

Hemerocampa vetusta Boisd. Orgyia canæ—Hemerocampa vetusta. gulosa—Hemerocampa vetusta. vetusta—Hemerocampa.



Figure 26. Dust mound about a tree to protect it from tussock moth larvæ after shaking them down.

LASIOCAMPIDÆ.

This Family includes three species of tent caterpillars Malacosoma which are at times highly injurious in orchards.

Clisiocampa americana—Epicnaptera. californica—Malacosoma. constricta—Malacosoma fragilis.

disstria—Malacosoma.
drupacearum—Malacosoma disstria.

Epicnaptera americana Harris.
erosa—Malacosoma. disstria.
fragilis—Malacosoma.
thoracica—Malacosoma.
Pseudoneustria—Malacosoma
californica—americana.
frutetorum (not California).
Gastropacha americana—Epicnaptera.

Lasiocampa carpinifolia—Epicnaptera americana.

Malacosma ambismilis—californica. californica Pack. constricta—fragilis. disstria Hubn. fragilis Stretch.

BOMBYCIDÆ.

The silk worm of commerce is found in this state only under domestication. See California circular 12.

Bombyx mori Linn.

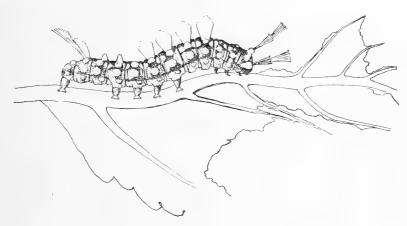


Figure 27. Tussock moth larva.

PLATYPTERYGIDÆ.

Drepana arcuata Walk.

siculifer Pack.

GEOMETRIDÆ.

The larvæ of the moths of this family have but ten legs, and walk with a peculiar looping motion and are called loopers, span worms or measuring worms. This peculiarity is also indicated by the name Geometridæ. The canker worms Alsophila and Paleacrita are the most injurious members of the family.

rubromarginaria—Xystrota
paticaria.
sideraria—Eois.
subalbaria—Eois anticaria.
Æthalodes packardia (Hulst.)
Æthyctera electa Hulst.
Alcis californiaria—imitata.
dejecta Hulst.
sulphuraria Pack.

he- Alsophila pometaria Harr.
Anagoga pulveraria Linn.
Anaplodes arizonaria Grote.
delicaria Dyar.
Acidalia ancellata—Cinglis.
californiaria—Eois sideraria.
dataria—Cosymbia.
granitaria—Eois.

magnetoria—Leptomeris.
depromaria Grote
imitata Walk.
latifasciaria (Pack.).
metanemaria Hulst.
obliquaria Grote.
pacificaria—Eois sideraria.
5-iinearia—Letomeris.
rubrolinearia—Leptomeris magnetaria.
festaria—arizonaria.
illustraria Hulst.
iridaria Guen.
pistacearia Pack.
brehmeata Gros.

Ania brehmeata Gros.
Anisopteryx pometaria—Alsophila.







Figure 28. The three most caterpillar pests attacking the foliage of the apple A. Canker worm. E. Tussock moth. C. tent caterpillar.

venata-Paleacrita. Annemoria faseolaria (Guen.). graefiaria Hulst. Apæcasia mercedulata Strech. Aplodes rubrifrontaria Pack. Aspilates opuscularia-Pterospoda. behrensaria-Deilinia. desperaria Hulst. dissimilaria Hubn. Azelina ancetaria Hubn. behrensata Pack. occidentalis Hulst. hubneraria-ancetaria. Bantria californiata—Euchoeca. Biston virginarius-Lycia. Boarmia californica-Alcis imitata. clivinoria-Selidosema clivinarium.
plumogeraria Hulst.
wrightiaria Hulst.
Brephos californicus Boisd.
melanis Boisd.
Caberodes confusaria Hubn.
Camptogramma fluviata—Percnoptilota.
Caripeta æqualiaria Grote.

Catopyrra ferruginosaria (Pack.). Cherodes ægrotata—Sabuloides caberata.

nubiliata—Sabluoides. Chesiadodes morosata Hulst. Chesias occidentaliata—(synonymy undetermined).

Chlorochlamys chloroleucaria Guen.
phyllinaria Zell.

Chlorochlystis inconspicua Hulst. Chlorosea fasciolaria—Annemoria. nevadaria Pack.

perviridaria—Annemoria faseo laria.

Choerades nubiliata—Sabuloides. Cidaria glaucata—Hydriomena sordidata.

> leoninata—Eurhinosea. mancipata—Eurhinosea. multilineata—Mesoleuca .implicata.

nubilata—Sabuloides.
4-punctata—Cœnocalpe magnoliata

rubrosuffusata—Rheumaptera. subochreata—Eurhinosea mancipata.

Cinglis ancellate Hulst.
Cleora atrofasciata—Siagraphia continuata.

caberata—Sabuloides.
correllatum Hulst.
formosata Hulst.
punctomacularia—Philedia.

Cœnecalpe annellata Hulst. carnata Pack. cœnonymphata Hulst. magnoliata Guen. oxygramma Hulst. phlebeculata (Guen.).

polygrammata Hulst.
Cœnocharis interruptaria Grote.
Coniodes plumigeraria Hulst.
Coremia californiata—Petrophora munitata.

convallaria-Petrophora.

defensaria-Petrophora. palebeculata-Coenocalpe. perpugnata-Gypsochroa desig- Enemera juturnaria Guen. nata Corphista badiaria Edw.

meadii Pack. Cosymbia dataria (Hulst). Cymatophora benigna Hulst. bicolorata Fabr.

bitactata Walk. californiaria-Platea. guenearia Pack. inquinaria Hulst. occiduaria Pack. subcessaria Walk. umbriferata Hulst.

Dasyfidonia avuncularia Pack.

Enchoria albifasciata Pack. osculata Hulst. Enypia venata Grote. Eois anticaria Walk.

granitaria Pack. lævitaria Hubn. lanceolata Hulst. microphysa Hulst. occidentata—Leptomeris occidentaria.

sideraria Guen. Epirrita 12 lineata-Venusia. Ersephila grandipennis Hulst. Eubolia custodiata—Hydriomena. Eucestia rotundata (Pack.). fuscata Gro.

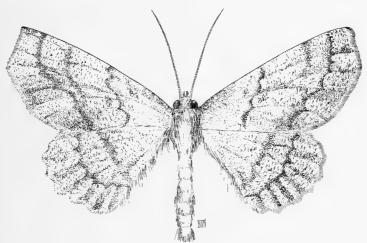


Figure 29. A Geometrid moth.

Deilinia behrensaria Hulst. carnearia Hulst. falcataria Pack. fœminaria Guen. fumosa Hulst. indurata Dyar. litaria Hulst. nevadaria Hulst. nigroseriata (Pack.) perpallidaria Grote. quadraria Grote.

Ectropis crepuscularia. D. & G. Ellopia californiaria—Platea. placeraria-Pherne.

Euchæna argillaria (Hulst.). falcata (Pack.). johnsonaria Fitch. Euchœca californiata Pack. cretaceata Pack. Eucrostis viridipennata Hulst. Eucymatogogne intestinata Guen. Eupithecia behrensata-Azelina. cretaceata-Euchœca. longipalpata-Mycteropoda. nevadata-Tephrodistis. rotundopuncta-Tephrodistis. subapicata—Tephrodistis Eurhinosea flavaria (Pack.).

leoninata (Pack.). mancipata (Guen.). Eustroma nubilata Pack. Eutrapela anafracta-Sabuloides. falcata-Euchlæna. nubilata-Sabuloides. Fidonia avuncularia-Dasyfidonia. Geometra illustraria-Anaplodes. iridaria-Anaplodes. iridaria-Anaplodes illustraria. rectaria-Anaplodes iridaria. Glaucina incorpriata Hulst. epiphysaria Dyar.

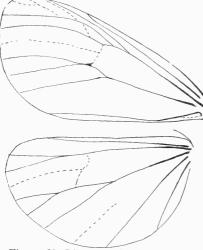


Figure 30. Diagram of the venation of the higher moths.

Glaucopteryx cretaceata—Euchœca. implicata-Mesoleuca. magnoliata-Coenocaple. Gonodontis formosa Hulst. Gorytodes uncanaria-Platea californiaria. Gymnocelis inferior Hulst. minuta Hulst. Gypsochroa designata Hubn. sitellata Guen.

Halia cineraria—Symphreta marcessaria.

4-linearia—Cymatophora

marcessaria-Symphreta.

tripunctaria-Symphreta. Hemerophila latifasciaria-Alcis. packardaria-Aethalodes. Hesperumia ochresata-Alcis sulphuraria. Heterolocha edwardsata-Neoterpes. Heterophleps triguttaria Her. Hydria undulata Linn Hydriomena amorata Hulst. autumnalis Strom. banavahrata Strech. californiata Pack. Holochroa dissociaria Hulst. indistincta Hulst. costiguttata Hulst. custodiata (Guen.). herbicolata Hulst. indefinata Gros.

packardata Gros. 5-fasciata—sordidata. sordidata Fabr. sparimacula Hulst. speciosata (Pack.). tæniata Steph. Hyperitis notataria Hulst.

latirupta Walk. neomexicana Hulst.

trianguliferata Pack. Hysepetes californiata-Hydriomena.

5-fasciata—Hydriomena sordidaspeciosata-Hydriomena. viridata-Hydriomena sordidata. Hyria occidentaria-Leptomeris.

Larentia cumatilis-Coenocalpe magnoliata. implicata-Mesoleuca. 12-lineata—Venusia.

Leptomeris magnetaria Guenee. occidentaria (Pack.). quinquelenearia Pack.

Lithostege rotundata-Eucestia. Lozogramma fæminaria-Delinia.

juturnaria-Enemera. nigrosehaata-Delinia. sabularia Guen. s-signata Pack.

Lycia virginaria (Grote). Cacaria calfiorniaria-Siagraphia. Marmarea occidentalis Hulst. Marmopteryx marmorata Pack.

Melanolophia canandaria (Guen.). bitac- Mesoleuca californiata-Hydriomena. packardata.

etnela Huist.

implicata (Guen.).
truncata Hubn.
vasaliata Guen.
Metanema argillaria—Euchæna.
aurantiacaria—Sabuloides.
cervinaria—Sabuloides.
forficularia—Sabuloides caberata.
forficularia—Guen.
inatomaria Guen.

inatomaria Guen. subpunctata Hulst. ocampa prægrandaria

Metrocampa prægrandaria Guen. viridoperlata—prægrandaria. Wiycte cphora longipalpata Hulst. Nenoria faseolaria—Annemoria. monticola Hulst.

Neoterpes edwardsata (Pack.). Nomenia unipecta Pear. Nepytia nigrovenaria Pack. umbrosata Pack.

Numeria californica (undetermined.) determined).

Nycterosea brunneipennis Hulst. Nyctobia nigroangulata Str. Ochyria abrasaria—Petrophora.

carneata—Cœnocalpe carnata.
gueneata—Hydriomena custodia-

ta.
lacteata—Trichochlamys.
lignicolorata—Zenophleps.
munitaria—Petrophora.
rubrosuffusata—Rheumaplero.

Odez:a californiata—Euchœca.
Opæcasia mercedulata Str.
Orthofidonia elsinora Hulst.
Paleacrita longiciliata Hulst.
vernata (Pack.).

Panagra flavofa ciata—Siagraphica neptaria.

subminiata—Siagraphica.
Percnoptilota fluviata (Hubn.).
Petrophora abrasaria H. S.

convallaria Guen.
defensaria Guer.
flavata—Eurhinosea flavaria.
leoninata—Eurhinosea.
mancipata—Eurhinosea.
munitata Hubn.
nemorella Hulst.
prunata—Eustromo nubiliata.
truncata—Mesoleuca.

Phasiana irrorata—Siagraphia. neptata—Siagraphia neptaria. subminiata—Siagraphia.

Phengommataea edwardsata Hulst. spoliata Gro.

Pterospoda perumbaria.
Pterotæa cariosa Hulst.
Procherodes catenulata—Sabuloides.
Racheia latipennis Hulst.
Rheumaptera basaliata—Hydriomena
tæniata.

brunnercillata—Mesoleuca gra tulata. delimiata War.

georgii (Hulst.). rubrosuffusata (Pack.). Sabulcdes anfractata Hulst.

aurantiacaria Pack.
caberata (Guen.).
catenulata Grote.
cervinaria (Pack.).
nubilata (Guen.).
truxaliata (Guen.).

Scelidacantha virginata Graef). Sciagraphia californiaria Pack.

continuata Walk.
denticulata Grote.
granitata Guen.
irrorata Guen.
muscariata Guen.
neptaria Guen.
sinuata Pack.
spondoplerata Hulst.
subminata (Pack.).

Scotosia californiata—Philereme. hæsitata—Triphosa dubitata.

Seridosema ætholodaria Dyar.
californiata-Enemera juturnaria.
tnrnaria.

clivinarium Guen.
correktatum Hulst.
delicatum Hulst.
humarium Guen.
lachrymosum Hulst.
laminarium Steck
wrightiarum Hulst.

Semiothisa denticulata—Siagraphia. inquinaria—Cymatophora. umbriferata—Cymatophora.

Sicya crocerariamacularia macularia Harr. Sigela penumbrata Hulst. Slossonia rubrotincta Hulst. stenocapilates Dyar. smithii Gro.

Sympherta marcessaria Guen. tripunctaria Pack. Synazis oblentaria Grote. Synchlora denticulata Walk. gratulata Walk.

hersiliata Guen. Pherne parallelia Pack. placearia Guen. Philedia punctomacularia Hulst. Philereme californiata Pack. Philobia enotata Guen. Philopsia nivigerata Walk. Philtaea elegantaria Edw. Platea californiaria Her. diva Hulst. Pleymria fulviata-Percnoptilota. georgii-Rheumaptera. Pteropoda opuscularia Hulst. liquoraria Guen. Synglochis perumbraria Hulst.

ta. lorquinaria-Sympherta tripunc-

taria. monicaria-Deilinia fœminaria. muscariata—Sciagraphia. neptaria-Sciagraphia. sabularia-Marcaria. unicobraria—Alcis sulphuraria.

Tephroclystis acutipennis Hulst. annulata Hulst. behrensata Pack. bivittata Hulst. brunneipennis Hulst. californiata-miserulata. cestata Hulst. cretata Hulst. implorata Hulst. laisata Streck. Iongipalpata Pack. miserulata Grote.

misturata Hulst. nevadata Pack. nimbicolor Hulst. nimbosa Hulst.

obscurior Hulst.

ornata Hulst. raveocostaliata Pack. rotundopuncta Pack. subapicata Guen.

unicolor Hulst.

Tephrosia californiara—(Synonymy undetermined). canadaria-Melanolophia.

carnearia-Deilinia. celataria-Deilina fœminaria. falcatria-Deilinia. fautaria-Thallophaga. ferruginosaria-Catopyrrha.

nevadaria-Deilinia. nigroseriata-Deilinia.

Tephina haliata-Sciagraphia granita- Tetracis @grotata-Sabuloides caberata.

aurentiacaria-Sabuloides. cervinaria-Sabuloides. edwardsiata-Neoterpes. mellitularia-Pherne placearia. parallelia-Pherne. trianguliferata—Hyperitis. truxaliata-Sabuloides.

Thallophaga fautaria Hulst.

Thamnonoma guenearia—Cymatophora mercessaria-Sympherta. 4-linearia-Cymatophora bitacta-

3-punctaria—Sympherta. Trichochlamys lacteata (Pack.). Triphosa badiaria Edw dubitata Pack.

pustularia Edw. Venusia cambrica Curt.

duodecemlineata (Pack.) virginata-Scelidacantha. Xanthrohœ nemoralla Hulst. Xystrota hepaticaria Guen. Zenophlips lignicolorata (Pack.).

obscurata Hulst.

TINEINA.

A family of small moths found on the trunks of trees, the larvæ feeding on lichens.

NOLIDÆ.

Celama anfracta Edw. aphyla Hamp. minna Bull. Noia apera Druce.

hyemalis-Celama minna. minuscula-Roseelia. Roseelia minuscula Zell.

PSYCHIDÆ.

The basket worms or bag worms belong to this family. None of the species are common in California.

Chalia fragmentella Edw. Hyaloscotes fumosa Butl. Oiketicus davidsoni Edw. Thyridopteryx meadii Edw.

THYRIDÆ

Belnoptera fratercula Pag. vitrina Boisd.

Dysodia oculatana Clem. Hexeris enhydris Grote.

COSSIDÆ.

The Cossidæ have wood boring larvæ. Cossus is quite common on cotton-

woods and poplars, and Prionoxystus on locust trees. The pupal skins of these insects are conspicuous objects on the trunks of these trees.



Cossus populi Walk.
Hypopta bertholdi Grote.
riversii Stretch.
Prionoxystus robiniæ (Peck.).
Xyleutes robinæ—Prionoxystus.



Figure 31. Venation of Cossidæ and related moths in which the independent vein crosses the cell. Dotted lines are veins not uniformly present.

SESIIDÆ.

Day flying moths with partly transparent wings making them resemble wasps. The larvæ bore into plants. The most injurious species is the peach tree borer, Sanninoidea. Our species is very similar to the equally troublesome eastern S. exitiosa.

The food plants of the other species are: — Pines and Redwood Vespamia, Poplars Ægeria and Memythrus, Locust Memythrus, Willows Ægeria, and Sesia albicornis, Sumac Melitta, Galls on Mesquit Sessia prosopis, Currants and Gooseberries Sesia tipuliformis and Strawberries Sesia rutilans.

SYNOPSIS OF GENERA.

Sesia. Ægeria and Paranthene: tongue rudimentary, the latter with tibia; tufted. Albuna and Memythrus: hind independent from middle of crossvein, the latter with palpi long haired. Sanninoidea: abdominal tufts of male not fan-like, female abdomen with lateral tufts.

Aegeria hemizonæ—Sesia. impropria—Sesia.

lupini—Sesia. mandariæ—Sesia rutilans. noveborasensis—Sesia. pacifica Edw. Albuna artemisiæ—Sesia mellinipennis.



Figure 32. Diagram of the venation of. Sesiidæ.

Pyrotænia achillæ-Sesia. behrensii-Sesia. polygoni—Sesia. Sanninoidea opalescens Edw. Sesia achillæ (Edw.). albicornis Edw. behrensii (Edw.) elda-behrensii. eremocarpi-achillæ. fragariæ Edw. helianthi-behrensii. orthocarpi-fragariæ. mellinipennis Boisd. neglecta Edw. novarœnsis (Edw.). pictipes G. & R. polygoni (Edw.).

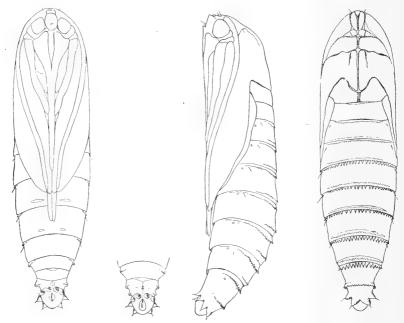


Figure 33 Pupa of the peach tree borer.

pyramidalis Walk.
resplendens—Sesia mellinipennis
Melittia glorioa Edw.
satyriniformis Hubn.
Memythrus robinæ Edw.
Paranthrene heucheræ (Edw.).

rileyana Edw.
rutilans Edw.
tipuliformis Clerck.
Trochilium pacificum—Aegeria.
Zenodoxus heŭcheræ—Paranthrene.
Vespamima seguoiæ Edw.

PYRALIDÆ.

This family includes the mediterranean flour moth Ephestia kuehniella, its near relative E. cautella a pest in this state on raisins, the indian meal moth Plodia interpunctella and the meal snout moth, Pyralis farinalis.

The bee moth, Galleria, also belongs here, and likewise the root web worms, Crambus, and a whole series of leaf folders and crumplers, including the grape leaf roller, Desmia.

Achroa grisella Fabr.

Bandera subluteella Rag.

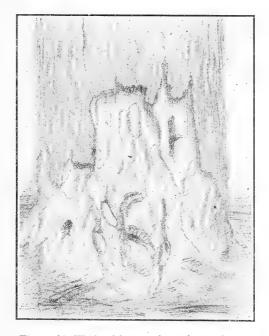


Figure 34. Work of larvæ of peach tree borer.

Ædis funalis—Evergrestis.
Acrobasis alatella—Myeolis.
tricolorella—Mineola.
Aglossa cuprealis Hueb.
Ambesa walsinghami Rag.
mirabile Dyar.
Annaphila immerens—Titanio.
Anerastia excantalis—Megaspis.
Anoristia olivella Hulst.
Aphomia sociella Linn.
Argyria auratella (Clem.)
Attacapa callipeplella Hulst.
Autocosmia nexalis Hulst.

Botis annaphilalis—Loxostege.
commortalis—Pyrausta.
dapalis—Titanio.
fodinalis—Pyrausta.
fumoferalis—Pyrausta.
lethalis—Pyrausta.
levalis—Pilocris inguinalis.
lulualis—Loxostege anartalis.
monulalis—Pyrausta mustelinalis.
mustelinalis—Pyrausta.
obnigralis—Pyrausta unifascialis.
nasonialis—Loxostege.

nexalis—Autocosmia.
octosignatus—Pyrausta.
offumalis—Loxostege.
perrubralis—Pyrausta.
profundalis—Pyrausta.
semirubralis—Pyrausta,
thrallophilalis—Loxostege.
unifascialis—Pyrausta
uxorculalis—Pyrausta nicalis.
vacunalis—Pyrausta.

Calamochrous straminea War. Cayuga bistriatella—gemmatella. gemmatella (Hulst.)

Chalcœla gemmalis Hulst. Chilo leachellus—Crambus. Cœnochroa californiella Rag.

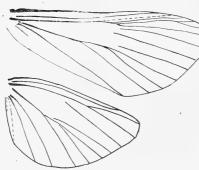


Figure 35. Venation of Pyralidæ.

Crambus albilineellus Fern. anceps Grote. attenuatus Grote. auratellus-Argyria. behrensellus-biothanatilis. biothanatilis Hulst. gausapilis Hulst. hastiferellus Walk. hortuellus (Hueb.) leachellus (Zin.) luteolellus Clem. occidentalis Grote. pascuellus (Linn.) periellus (Scop.) pusionellus Zell. toparius-hortuellus. ulæ-luteolellus. undatus Grote. unistriatellus Pack. vulgivagellus Clem. Cybalomia extorris Led.

Dakruma coccidivora—Lætilia. Dasypyga alternosquamella Rag. Desmia funeralis Hueb. Diaphania hyalinata Linn. Diasemia eleganialis War. Diastictis cæcalis War. Dicymolomyia metalliferalis Pack. opuntiellis Dyar. Dioryctria calrioralis Walk. Dolichorhinia aureofasciella Rag. Eccopsia serratilineella Rag. Elasmopalpus decoralis Walk. Emprepes nuchalis-Noctuelia. Ephestia albocostalis-Epischnia. cautella Walk kuehniella Zell. nigrella Hulst. opalescella Hulst. Ephestoides erythrella Rag. gilvescentella Rag. nigrella Hulst. Epischnia albocostalis (Hulst.) boisduvaliella Guen. fulvirugella Rag. granitella Rag. ruderella Rag. Etiella schisticolor Zell. zinckenella (Treit.) Euchromius ocella—Ommatopteryx. Eurycreon anartalis-Loxostege. Eurythmia coloradella Hulst. Eustixia octonalis Zell. Euzophera semifuneralis (Hulst.) Evergrestis funalis Grote. napæalis Hulst. rimosalis Guen. straminalis Hueb. Galleria mellonella Linn. Glyptoteles rhypodella-Nephopteryx. Herculia olinalis Guen. Homœosoma albiscentellum Rag. impressale Hulst. mucidellum Rag. opalescellum Hulst. Honora canacostella-montinatatella. mellinella Grote. montinatatella Hulst. oblitella Clem. ochrimaculella-mellinella. scinrella Rag. undulatella-oblitella. Hornigia lugubrella—Moodna. Lætilia coccidivora (Coms.)

Lineodes integra Zell.

Liopasia ternalis Led.

Lipographis fenestrella (Pack.) humilis Rag. leoninella—fenestrella.
Loxostege anartalis Grote. annaphilalis Grote. chortalis Grote. flavalis Fern. flavifimbrialis War. linealis Fern. napæalis—Evergrestis. nasonialis Zell. oberthuralis Fern.

quadristrigalis Fern.
morenalis Dyar.
Mineola calignella (Hulst.)
tricolorella (Grote.)
Monocona rubralis War.
Moodna lugubrella Rog.
Myelois alatella (Hulst.)
corniella (Grote.)
grossipunctella Rag.
Nephopteryx caliginella—Mineola...
crassifasciella Rag.
fasciolalis (Hulst.)



Figure 36. The grape leaf roller.

offumalis Hulst.
similalis Guen.
sticticallis Linn.
thallophilalis Hulst.
triumphalis Grote.
Lygropia rivulalis Ham.
Manhatta lugubrella—Moodna.
Megaphysis edwardsiallis—Megasis.
Megasis cinctella Hulst.
edwardsialis (Hulst.)
excantalis (Hulst.)
Metasia argalis Fern.

fenestrella—Lipographa.
geminipunctella—ovalis.
leoninella—Lipographis fenestrella.
oblitella—Honora.
ovalis (Pack.)
perfuscalis—Sarata.
rhypodella (Hulst.)
scintillans—Pyla.
semifuneralis—Euzophera.
subtinctella Rag.
undulatella—Honora oblitella.

Noctuelia nuchalis Grote. simplex War. Nomophila noctuella D. & S. Ommatopteryx ocella (Haw. Omphalocera dentosa Grote. Orobæna octonalis—Eustrixia. Ortholepsis jugosella Rag. Pachyzancla periusalis Walk. Palparia ocella-Ommatopteryx. Parædis napælis Hulst. Passadena constantella Hulst. Pempelia albipenella-Staudingeria. fenestrella—Lipographis. leoninella-Lipographis fenestrelovalis-Nephopteryx.

coccinea War. commortalis Grote. fodinalis Led. fumoferalis Hulst gracilalis Hulst. laticlavia G.& R. lethalis Grote. mustelinalis Pack. nicalis Grote. octosignalis Hulst. perrubralis Pack. rubricalis Hueb. semirubralis Pack. subnicalis War. unifascialis Pack.





Figure 37. Larva of the grape leaf roller.

Peoria albidella Hulst. Phalena pascuellus-Crambus. perlellus-Crambus. Phlyctænia externalis War. ferrugalis Hueb. indistinctalis War. profundalis Pack. Phorasea simalis Grote. Phycis zinckenella—Etiella. Pilocrocis inguinalis Guen. Pinipestris fasciolalis—Nephopteryx. Plodia interpunctella Hueb. Pseudoschœnobius opalescalis (Hulst.) Selagia olivella-Anorista. Pyla bistriatella Hulst. scintillans (Grote.) Pyralis farinalis Linn. Pyrausta angustalis Grote.

versicolor War. Ragonotia dotalis Hulst. Salebria ochripunctelia Dyar. Saluria ardiferella Hulst. dichrocella Rag. rostrella Rag. Sarata perfuscalis (Hulst.) umbrella Dyar. Schenobius opalescalis-Pseudoschenobius. Scoparia atropicta Ham. centuriella D. & S. rectilinea Zell. refugalis-rectilinea Zell. Spermatophthora gemmatella—Cayuga.

vacunalis Grote.

Staudingeria albipenella (Hulst.)
Stemmatophthora nicalis—Pyrausta.
Stenophyes huronalis Guen.
Stericta trabalis—Yuma.
Symphysa eripalis Grote.
Thaumatopsis coloradella Kear.
Tinea hortuellus—Crambus.
Titanio dapalis Grote.
immerens (Hav.)
nuchalis—Noctuelia.

proximalis Fern.
Unadilla erronella Zell.
Urulla incongruella Hulst.
Valdivia mirabelicanella Dyar.
Vitula serratilineella—Eccopsia.
Yuma adulatalis—trabalis.
Xanthippe descansales Dyar.
trabalis Grote.
Zophodia fuscatella Hulst.
packardella Rag.

PTEROPHORIDÆ.

This and the following family are called plume moths because of the very remarkable splitting of the wings shown in the acompanying figure.



Figure 38. A plume moth.

Aciptalis cinerascens—Alucita.
montanus—Alucita.
Alucita cinerascens (Wals.
cosmodactyla—Platyptilia.
montana (Wals.)

Amblyptilus cosmodactyla—Platyptil- Platyptilla acanthodactyla Hueb.

picta—Platyptilia. Lioptilus augustus—Pterophorus. grandis—Pterophorus.

homodactylus—Pterophorus. inconditus—Pterophorus. monodactylus—Pterophorus. paleaceus—Pterophorus. parvus—Pterophorus. subocraceus—Pterophorus.

sulphureodactylus—Pterophorus.
Mimescoptilus exclamationis—Stenoptila.

Ctita.

Cedematophorus baroni—Pterophorus.
cretidactylus—Pterophorus.
eupatorii—Pterophorus.
guttatus—Pterophorus.
gratiosus—Pterophorus.
grisesceus—Pterophorus.
lugubris—Pterophorus.

Oxyptilus bernardinis Gri.
deliwaricus Zell.
nigrociliatus—tenuidactylus.
ningoris Wals.
tenuidactylus Fitch.
Platyptilla acanthodactyla Hueb.

adusta Wals.
albidorsella Wals.
albida Wals
bertrami—marginidactyla.
cardui—carduidactyla (Ril.)
cooleyi Fern.
cosmodactyla Hueb.
fragilis Wals.
grandis Wals.
hesperis Gri.
marginidactyla Fitch.
marmarodactyla Dyar.
modesta Wals.

modesta Wals.
monticola Gri.
pasidensis Gri.
percnodactyla Dyar.
picta (Wals.)
shastæ Wals.
williamsii Gri.

Pterophorus augustus (Wals.) baccharidis Gri. baroni (Fitch.) behrii Gri. carduidactyla-Platyptilia. catalinæ Gri. cretidactylus Fitch. dacteodactylus-subocraceus. eupatorii (Zell.) gorgoniensis Gri. grandis (Fitch.) gratiosus (Fitch.) grisescens (Walsh.) guttatus (Wals.) hilda Gri. homodactylus Walk.

inconditus (Wals.)

lugubris (Fitch.)
marginidactyla—Platyptilia.
monodactylus (Linn.)
paleaceus (Zell.)
parvus (Wals.)
pictipennis Gri.
rileyi Fern.
subochraceus (Wals.)
sulphureodactylus Pack.
tenuidactylus—Oxyptilus.
Stenoptila californica Gri.
exclamationis (Wals.)
gorgoniensis Gri.
Trichoptilus lobidactylus Fitch.
pygmæus Wals.

wrightii Gri

ORNEODIDÆ.

 $\begin{array}{ccc} Alucita & hexodactyla -- Orneodes & Orneodes & hexadactyla \\ & montana -- Orneodes & hexadactyla \end{array}$

TORTRICIDÆ.

The codling moth, Cydia pomonella, is by far the most important member of this family and perhaps of all Lepidoptera. The orange tortrix figured is not of great economic significance.

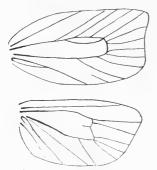


Figure 39. Venation of Tortricidæ

Alcerys americana (Fern.)
foliana (Wals.)
nivisellana (Wals.)
permutana (Dup.)
Amorbia cuneana (Wals.)
Anchylopera biarcuana—Ancylis.
Ancylis biarcuana (Steph.)
cometana (Wals.)
comptana (Fol.)
pacificana (Wals.)
Archipsafflictana (Walk.)
argyrospila (Walk.)

cerasivorana (Fitch.)
rosaceana (Harr.)
virescana (Clem.)
k'ndermanniana—Phalonia.
latipunctana—Phalonia.
parallelana—Phalonia.
smeathmanniana—Phalonia.
transversana—Phalonia.

Cydia cupressana Kear.
inquilina Kear.
pomonella Linn.
Diachelia tunicana—Epagoge.
Dichrorampha plumbana—Hemimene.
Carpocapsa californiana—Epagogne.

pomonella—Cydia.
Carposina commonana Kear.
crescentella Wals.

Cacecia argyrospila—Archips.
roseaceana—Archips.
Commophila macrocarpana Wals.
umbrabascana Kear.

Conchylis campicolana—Phalonia fernaldana—Phalonia. intactana—Phalonia. Eccopsis punctana—Exartema.

Enarmonia americana (Wals.)
bracteateana (Fern.)
edwardsiana Kear.
larimana Wals.

luna Kear.
placerana Kear.
tana Kear.
trosulana (Wals.)
vana Kear.
wana Kear.
Epagoge californiana (Wals.)
tunicana (Wals.)
Epinotia augustana Hueb.
incarnana (Wals.)
lagopana (Wals.)
liturana (Wals.)
purpurciliana (Wals.)

maculatana (Wals.)
miscana Kear.
nigralbana (Wals.)
paljana (Wals.)
palusana Kear.
passerana (Wals.)
perdricana (Wals.)
primulana (Wals.)
pulveratana (Wals.)
rectiplicana (Wals.)
serpentana (Wals.)
shastana (Wals.)
sonomana Kear.

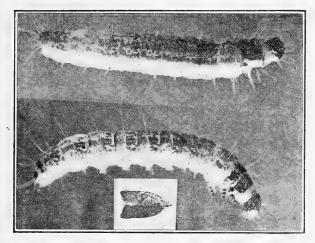


Figure 40. Larvæ and moth of the orange Tortrix.

Euchromia hemidesma-Olethreutes. Eucosma agricolana (Wals.) albangulana Wals. atomosana (Wals.) basipunctana (Wals.) biquadrana (Wals.) bolanderana (Wals.) canana (Wals.) cataclystiana (Walk.) crambitana (Wals.) culminana (Wals.) fulminana (Wals.) grandiflavana (Wals.) hirsutana (Wals.) irroratana (Wals.) juncticiliana (Wals.) larana (Wals.)

Iuridana (Wals.)

subplicana (Wals.) terracoctana (Wals.) trigeminana (Steph.) vomanana Kear. Eudemis vaccininana (Pack.) Eulia gloverana (Wals.) niscana Kear. Evetria colfaxiana Kear. monophylliana Kear. pasadana Kear. sabiniana Kear. siskiyouana Kear. zozana Kear. Exartema punctana Wals. Glyphiptera permutana-Alceris. Grapholitha americana-Enarmonia. bracteatana-Enarmonia. rœssleri-Triodia.

perangustana (Wals.)
puncticostana (Wals.)
rivulana (Scop.)
rubipunctana Kear.
scalana (Wals.)
subplicana Wals.
terracostana Wals.
trigeminana Steph.
utricana (Hueb.)
vetulana (Wals.)
Pandemia albaniana (Wals.)
pyrusana Kear.
Pedisea—Eucosma.

Pedisca—Eucosma.
Penthina conditana—Olethreutes.
consanguiana—Olethreutes.

trossulana—Enarmonia.
Hemimene plumbana Scop.
Herdecanema filiana Busk.
fraternana Busk
Hendecastema. cuneana—Amorbia.
Hysterosia fulviplicana (Wals.)
inopiana (Haw.)
Hystricophora leonana Wals.
Idiographis flaviplicana—Hysterosia.
inopiana—Hysterosia.
Laphoderus gloverana—Eulia.
Loxostænia afflictana—Archips.
cerasivorana—Archips.
franciscana—Tortrix.
rossceana—Archips.

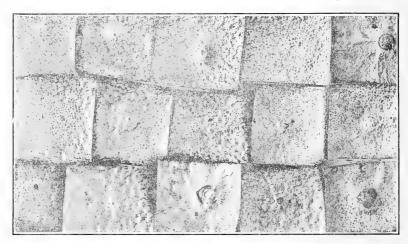


Figure 41 Pieces of orange rind showing entrance holes made by the larva of the orange Tortrix.

hebesana—Olethreutes.
hemidesma—Olethreutes.
Phæcasiophora—Eucosma.
Phalonia basiochreana Kear.
campicolana (Wals.)
carmelana Kear.
fernaldana (Wals.)
formonana Kear.
intactana (Wals.)
kindermanniana(Treits.)
latipunctana (Wals.)
obispoana—carmelana.
parallelana (Wals.)
smeathmanniana (Fabr.)

virescana—Archips.
Mellisopus latiferreanus Wals.
Œnectra inconditana—Sparanothis.
pilleriana—Sparganothis.
rudana—Sparganothis.
senecionana—Sparganothis.
Olethreutes chalybeana (Wals.)
conditana (Wals.)
consanguinana (Wals.)
grisiocapitana (Wals.)
hebesana (Wals.)
hemidesma (Zell.)
infuscana (Wals.)
minimana (Wals.)

transversana (Wals.)
vachelliana Kear.
Phoxopteris biarcuana—Ancylis.
cometana—Ancylis.
pacificana—Ancylis.
proteopteryx albicapitans Kear.
emarginana Wals.
Pseudoconchilis laticapitana
Pyralis smeathmanniana—Phalonia.
Retinia argyrospila—Archips.
Rhopalobola vacciniana Eudemis.
Sciaphila afflictana—Archips.

urticana Hueb.
vetulana—Olethreutes.
Sparganothis inconditana Wals.
pilleriana (Schif.)
rudna Wals.
senecionana Wals.
Smicrates virescana—Archips.
Spilonota trigeminana—Eucosma.
Steganoptycha augustana—Epinotia.
incarmana—Epinotia.
lagopana—Epinotia.
liturana—Epinotia.
purpuriciliana—Epinotia.

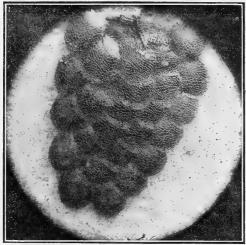


Figure 42. Photomicrograph of the eggs of the orange Tortrix.

argentana—Tortrix.
hebesana—Olethreutes.
puncticostana—Olethreutes.
trigonana—Tortrix.
vacciniana—Eudemis.
Semasia artemisiana Triodia.
bucephaloides Wals.
griseocapitana Wals.
infuscana—Thiodia.
minimana—Thiodia.
pallidicostana—Thiodia.
perangustana—Thiodia.
rœssleri—Thiodia.
terminiana—Thiodia.
Sericaris chalybeana—Olethreutes.
puncticostana—Olethreutes.

Synnoma lynosyrana Wals.
Teras albaniana—Pandemis.
americana—Alcerys.
foliana—Alcerys.
nivisellana—Alcerys.
permutana—Alcerys.
Thiodia apachena Wals.
artemesiana (Wals.)
daracha Kear.
griseocapitana Wals.
infuscana Wals.
minimana Wals.
offectalis Hulst.
pallidicostana (Wals.)
perangustana Wals.

rœssleri (Zell.) scalana Wals. tenuiana (Wals.)
Tinea pomonella—Cydia.
Tortrix argentana Clerck.
augustana—Epinotia.
citrana Fern.
comptana—Ancylis.
franciscana (Wals.)

incarnana—Epinotia. inopiana—Hysterosia. pilleriana—Sparganothis. trianguiana Kea. trigonana (Wals.) urticana—Olethreutes.



Figure 43. Photograph of an orange Tortrix on an orange near a larval entrance.

HYPONOMEUTIDÆ.

Aræolepia subfasciella Wals.
Calantica polita Wals.
Cerastoma cervella Wals.
instabiliella—Trachoma.
kœbelella Dyar.
radiatella Don.
sublucella Wals.

Chalcæla Gemmalis—Choreutis silph- Plutella albidorsella Wals.

ella.
Choreutis bjerkandella Thumb.
dyarella Kear.
occidentella Dyar.
silphiella Grote.
sororculella Dyar.
Euceratia castella Wals.

securella Wals. Glyphipteryx bifasciata Wals. californiæ Wals. quinqueferella Wals.
regalis Wals.
unifasciata Wals.
Orchemia diana Hueb.
Periclymenobius canariellus Wals.
dentiferellus Wals.
frustellus Wals.
Plutella albidorsella Wals.
cruciferarum—maculipennis.
maculipennis Curt.
omissa Wals.
porrectella Linn.
vanella Wals.
Setiostoma fernaldella Ril.
Trachoma falciferella Wals.
instabilella Wals.

senex Wals.

GELECHIIDÆ.

The peach worm, Anarsta lineatella was particularly troublesome to growers of peaches for eastern shipment, until the discovery of the efficiency of spraying with lime sulfur after the buds were swollen. (See California Bulletin 144). Another important pest is the potato worm Phthorimæa operculella. (See California Bulletin 135).

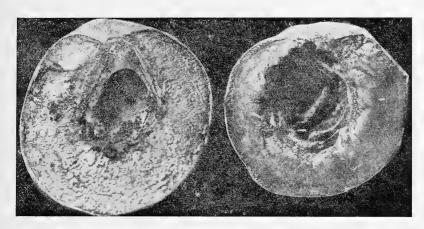


Figure 44. Peach showing a peach worm and its work.

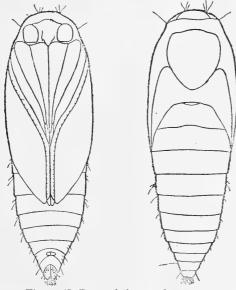


Figure 45. Pupa of the peach worm.

Anacampsis rhiofructella (Clem.) Aristotelia argentifera Busk. Anarsia lineatella Zell.

roseosuffusella Clem.

Cleodora canicostella—Paltodora.

modesta—Paltodora.
sabulella—Paltodora.
striatella—Paltodora.
tophella—Paltodora.
Dactylota snellenella—Neodactyla.

operculella—Phthorimæa. paulella (Colorado.) rhoifractella—Anacampsis. roseosuffusella—Aristotelia. thoracestrigella Chamb. variabilis Busc.



Figure 46. Young larva of the peach worm.



Figure 48. Winter nest of the peach wo n.

sabulella (Wals.)

striatella (Hueb.)

Deoclona yuccasella Busk.

æquepulvella—Glyphidocera.
apicitripunctella—Recurvaria.
Eucatoptus striatella—Phthorimæa.
Gelechia discostrigella Chamb.
griseochrella Chamb.
lacteochorella Chamb.
maculatusella Chamb.
occidentella Chamb.
ocherfuscella Chamb.
ocherfuscella Chamb.
ocherostrigella Chamb.
ochreostrigella Chamb.

Glyphidocera æquipulvella (Cham.)
Gnorimoschema baccharisella Busk.
coquillettella Busc.
occtomaculella (Chamb.)
tetradymiella Busc.
Lita solanella—Phthorimæa operculella.
Neodactylata snellenella Wals.
Paltodora canicostella (Wals.)
modesta (Wals.)

tophella (Wals.) Phthorimæa operculella (Zell.) . striatella (Murt.) Recurvaria apicitripunctella Clem.

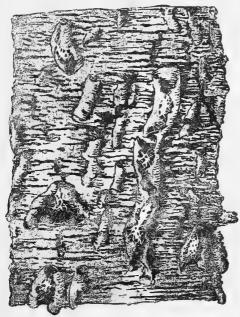


Figure 49. Cocoons of the peach worm in the curls of the bark.

XOLORICTIDÆ.

Ide osseella Wals.

ŒCOPHORIDÆ.

Depressaria arenella Schif. argillacea Wals. arnicella Wals. ciliella Stain. emeritella Stain. klamathiana Wals. novimundi Wals. nubuferella Wals. posticella Wals. psoraliella Wals. sabulella Wals. thoracefasciella (Cham.) thoracenigraella (Cham.) togata Wals. umbraticostella Wals. Endresis lactella D. & S.

Ethmia albistrigella Wals.
 albitogata Wals.
 arctostaphyella Wals.
 monticola Wals.
 obscurella Beut.
 subcærulea Wals.

CEcophora dimiidella Wals.
 pseudospretella Wals.

Psecadia albistrigella—Ethmia.
 arctostaphylella—Ethmia.
 monticola—Ethmia.
 obscurella—Ethmia.
 subcærulea—Ethmia.

Setiostoma fernaldella Ril.

Walsinghamia diva Ril.

BLASTOBASIDÆ.

Blastobasis iceryæella—Holcocera.
Dryope canariella Dietz.
occidentella Dietz.
fenyesella Dietz.
Holcocera iceryæella Ril.

inconspicuua Wals. irenica Wals. gigantella Cham. stygna Wals. Valentina glandulella Ril.

ELACHISTIDÆ.

Butalis aterrimela—Scythris. ochristriata—Scythris. perspicella-Scythris. suffusa-Scythris. Coleophora accordella Wals. acutipenella Wals. bella Wals. costipenella Wals. cornella Wals dicscostriata Wals. glaucella Wals. glutinosa (undetermined.) irroratella Wals. lapidicornis Wals. laricella Hueb. lynosyridella Wals. ochrella Cham. ochrostriata Wals. pruniella Clem. tennis Wals.

vagans Wals viridicuprella Wals. viscidiflorella Wals. wythiæ Wals. Cosmopteryx unicolorella Wals. Heliodines bella Chamb. extraniella Wals. unipunctella Wals. Laverna bifasciella-Mompha. decorella-Mompha. subbistrigella-Mompha. unifasciella-Mompha decorella. Scythris aterrimella (Walk.) ochristriata (Walk.) perspicella (Walk.) suffusa (Walk.) Mompha bifasciella Chamb. decorella (Steph.) subbistrigella (Haw.) Schreckensteinia felicella Wals.

TINEIDÆ.

The Tineidæ are best known because of three household pests; the clothes moth, Tineola, the carpet moth, Trichophaga and the fur moth, Tinea pellionella. Of greatest scientific interest are the yucca moths, Pronuba being necessary to fertilize the blossoms and Prodoxus living on the flower stems can come to matnrity only where the Pronuba has preformed its work. Yucca brevifolia is attended by Pronuba paradoxa and Prodoxus sordidus Yucca baccata and other allied yuccas are fertilized by Pronuba yuccasella and furnish food for Prodoxus coloradensis and y-inversa, and Yucca whipplei has Pronuba maculata and all the remaining species of Prodoxus.

Adela fasciella—Trigrapha.
flamesella Cham.
lactimaculella—flammeusella.
punctiferella Wals.
septentrionella Wals.
trifasciella Cham.
trigrapha Zell.
Amydria coloradella Dietz.

confusella Dietz.
confusella Dietz.
obliquella Dietz.
occidentella—onagella.
Apotomia fractilinella Dietz.
Apreta paradoxella Dietz.

Agryrestia cuprasella Wals.
mendica Haw.
plicipunctella Wals.
onagella Dietz.
pandurella Dietz.
Bebellia somnulentella Zell.
Buculatrix euratiella (undetermined).
Cremastobombycia grindelilella—Lithocoletes.
Epielegis cariosella Dietz.

Calopacta glutinosi Wals.
Cerostoma flavistrigella Busk
Epichata nepotella Dietz.

Eriocrania cyanosparsella Wil. Ethmia albatogata Wals. Gracilaria behrensiella Chamb.

elongella Linn.
fuscoochrella Beut.
nigristrigella Beut.
grindeliella (Wals.)
incanella Wals.
insignis Wal.
ledella Wals.
leucothorax Wals.
mediodorsella Braun.
nemoris Wals.
propinquinella Braun.
salicifoliella Clem.
umbellnlariæ Wals.

Monopsis crocicapitella Clem. rusticella Hubn. Ortholophus variabilis Wals. Paralechia californica Busk. Phyganeopsis brunnea Wals. Pliniaca bakerella Busk.

sparsisquamella Busk. Prodoxus ænescens Ril.

cinereus Ril.
coloradensis Ril.
marginatus Ril.
pulvurulentus Ril.
reticulatus Ril.
sordidus Ril.
y-inversus Ril.

Pronuba maculata Ril.
paradoxa Ril.
synthetica—paradoxa.
vuccasella Ril.

Paraneura cruciferella Dietz. Phryganopsis brunnea Wals. Spardia gracilis Wals. Semiota transverstrigella Dietz. Setomorpha majorella Dietz. Tinea arcella Fabr.

ehrhorniella Dietz.
simulella Dietz.
behrensella Chamb.
cloacella Haw.
defectella Zell.
geniculatella Dietz.
molybanella Dietz.
niveocapitella Chamb.
occidentella Chamb.
pellionella Linn.

Tineola biselliela Linn. Tscheria badiella Chamb. ceanothi Wals.
sulphurea—badiella.
Trichophaga tapetzella Linn.
ruptostrigella—nigristrigella.
sanguinella Cham.
sauzalitoella Cham.
shastella Beut.
Greya humilis (Wals.)
mediostriatella—Isocorypha.
punctiferella (Wals.)
solenobiella (Wals.)
Homoseta maculatella Dietz
Incurvaria humilis—Greya.

punctiferella-Greya.

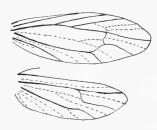


Figure 50. Venation of the larger Tineidæ.

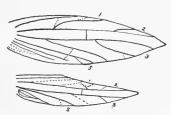


Figure 51. Venation of the smaller Tineidæ.

solenobiella—Greya.
Lecithocera flavistrigella—Greya mediostrigella.

faginalla (Flynopean)

faginella (European.)
Lithocolletes agrifoliella Braun.
alnicolella Wal.
alniella (European.)
apicinigrella Braun.
arbutusella Braun.
basistrigella Chamb.
conglomeratella Zell.

HEPIALINA.

HEPIALIDÆ.

Hepialis anceps montanus.

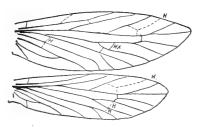


Figure 52. Venation of Hepialidæ and Micropterygidæ.

baroni—montanus.
behrensii Stretch.
californicus Boisd.
hectoides Boisd.
hyperboreus Mots.
inutilis—hectoides.
lembertii Dyar.
lenzi—hectoides.
meglashani—hyperboreus.
mendocineolus—sequoiolus.
modestus—hectoides.
montanus Stretch.
rectus—montanus.
sequoiolus Behrens.

MICROPTERYGIDÆ.

Epimartygyia pardella (Wals.) Eriocephala aurosparsella (Wals.) Micropteryx aurosparsella—Eriocephala.
pardella—Epimartyria.

HYMENOPTERA.

In the geological stratum in which the first moths appear there are representatives of most of the larger groups of Hymenoptera, indicating that it is an older order. The structure of the lower forms shows a very close relationship with the Lepidoptera and with the Trichoptera universally recognized as the ancestor of Lepidoptera. From the same group the Hymenoptera must also have sprung. The adult insect does not give any very clear evidence of this or of any other relationship.



Figure 53. Venation of the Honey bee.

The most distinctive structure is the dominance of three series of crossveins in the wing which render the venation difficult to interpret or compare with other venations. The first series of cross-veins extends from the front edge just before the node obliquely towards the base till it reaches the next vein, then turns squarely towards the next vein beyond, marking off two comparatively large basal cells. The second zigzags directly across the wing touching the costa just beyond the node. The third is a little more indefinate. It is usually about midway between the second crossveins and the tip of the wing. The usual conception of the venation hinges on the marginal cell, which is the large cell along the costa beyond the node. Below this are two or three submarginal cells and the remainder of the closed cells are called discoidal cells. The veins radiating from the marginal cell are

called transverso-cubital veins. The cubital vein arises from the basal cross-vein. On the other side of the cubital there are usually two cross veins which because of their direction are called recurrent veins.

A system of formulæ has been devised for expressing the salient features of a venation and to aid in rapid identification of groups. The plan is to number the bars surrounding the discoidal cell between the recurrent veins. The first recurrent vein is numbered 1, then along the cubital to the first transverso-cubital vein is numbered 3. etc. Even numbers are given to the bars beneath the cell. Where bars are without the cell as is common with bar 3, it is indicated by as *. The formula consists in naming in the order of size, the bars of a venation, enclosing in parentheses such as may be about equal in size.

Below will be found the formulæ of most of our genera of bees:-

Colletidæ	Colletes	4 1 6 2 3* 7 5 9*
Prosopidæ	Prosopis	4 1 5 6 2 7*
Andrenidæ	Andrena	4 1 5 2 6 3* 7*—4 1 (2 6 7) 3* (5 9*)
	Halictus	1 4 6 3* 7 2 9* 5—4 1 7 2 3* 9* ə
		1 4 6 (2 7) 3* 9* 5
	Sphecodes	1 6 4 2 7 9* 3* 5
	Agapostemon	4 1 6 7 2 3* 9* 5
Panurgidæ	Calliopsis	4 1 6 5 2 3* 7*
	. Panurginus	- 4 1 (5 6) 2 3* 7*
	Diandrena	4 1 6 5 2 3* 7*
	Perdita	1 5 2 3*
Anthophoridæ	Anthophora	1 4 6 2 7 (3* 5) 9*-4 1 6 2 7 3* 5 9*
	Melissodes	4 1 7 (2 6) 3* 5 9
	Tetralonia	4 1 7 2 6 3* 5 8*
	Xenoglossa	4 1 7 6 2 3* 5 9*
Melectidæ	Pseudomelecta	1 4 6 2 3* 7 9* 5
	Epiolus	1 4 6 2 7 5 3* 9*
Xylocopidæ	Xylocopa	4 1 6 5 2 7* 3*
Megachilidæ	Alcidamia	4 1 6 2 5 3* 7*
	Anthidium	6 5 4 1 2 3* 7*
	Chelostoma	4 1 5 6 2 7* 3*
	Megachile	4 5 1 6 2 3* 7*
	Osmia	4 1 6 5 2 3* 7*
	Ashmeadella	4 1 6 5 2 3* 7*
Nomadidæ	Nomada	1 4 6 2 3* 9* 7 5—1 4 6 2 3 7 (5 9)
	Melecta	4 1 6 2 3* 7 9* 5
Ceratinidæ	Ceratina	4 1 6 7 3* 2 9* 5
	Bombus	4 1 6 7 5 2 3* 9*
Bombidæ	Psythyrus	4 6 1 7 2 5 3* 9*
Apidæ	Apis	4 5 6 1 2 7 3* 9*

The difficulty already alluded to in comparing the venation found in this order can be solved in one of two ways, either by assuming 1st. a great amount of fusion of the elements of the venation and of rearrangements of position, or 2nd. simply the suppression of certain parts.

The former has been worked out in detail by Comstock and Mac Gillvray They assume that the media is fused with the radius until just before the node where it is turned obliquely backward to the base of the cubitus and then

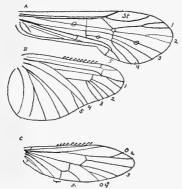


Figure 54. Venation of Trichopterygidæ. A. and B. Chloropsyche. C. Helicopsyche. 1-5 notation of veins used in that order. St. area in which stigma is supposed to develop. O. veins which are vestigial in Hymenoptera.

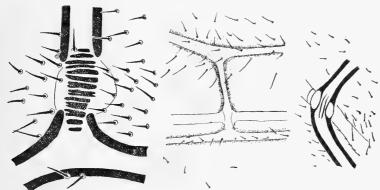


Figure 55. Three interruptions of veins on fold lines.

turned outward again to the base of the first recurrent which is its posterior branch; both branches subsequently fork and ultimately the tips unite as follows: the upper fork with two branches of the radius, the two middle forks with each other thus enclosing the third discal cell, and the lower fork

with the tips of the cubital and anal veins.

The second solution explains the peculiar crookedness of the median cross-veins and the spurs projecting from it into the second and third discoidal cells and from the first cross-vein into the first basal cell, as vestiges of suppressed veins which, if added, would at once make this wing conform in every essential feature with the wing of the Trichoptera.

There are two fold lines in the front wing in Hymenoptera, best developed in the paper wasps and their allies where the wings at rest are completely folded flat, making the wing appear to be very narrow.

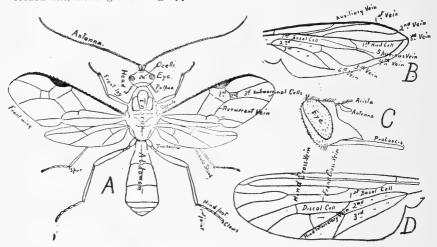


Figure 56, showing names of structures in Hymenoptera and Diptera

SYNOPSIS OF FAMILIES.

Ichneumonidæ: first cubital and first discoidal cells confluent and both recurrents present.

Proctotrupidæ: ovipositor at tip of abdomen. Pelecinidæ: abdomen very long and slender.

Mutillidæ: body densely clothed with hair.

Anthophoridæ: tongue long and a dense brush on hind tibiæ. Apidæ and Bombidæ: hind tibiæ concave on outer end, the first being devoid of spurs on hind tibiæ. Xylocopidæ: marginal cell long.

Megachilidæ: densely hairy beneath abdomen.

Cynipidæ: veins distant from costa. Ceroptridæ: second abdominal segment covering nearly the whole abdomen.

Formicidæ: abdomen constricted at base forming one or two hump-like segments.

Braconidæ: pronotum touching tegulæ, and trochanter two-jointed, Ean-

iidæ: abdomen attached to dorsum of thorax. Alysiidæ: mandibles spreading outwardly.

Crysididæ: abdomen of three to five segments, hollowed out beneath.

Nomadidæ: first joint of hind feet long, and three cubital cells. Andrenidæ and Coletidæ: basal joints of labial palpi similar to outer joints, the last with tongue acute. Ceratinidæ: marginal cell long.

Encyrtidæ: trochanters two-jointed, Eulophidæ: axillæ reaching as far as opposite the tegulæ. Torymidæ, Eurytomidæ, Miscogasteridæ, Cleonidæ and Pteromalidæ: female with femoral furrows, the last with but one spur on hind tibiæ, the first with pronutum elongate or hind coxæ longer that front coxæ; the second with pronotum subquadrate, and fourth with mesepisternum large and triangular.

Tenthredinidæ: abdomen not at all constricted at base, third submarginal receiving a recurrent vein, Hylatomidæ: antennæ three-jointed. Doleridæ: basal vein joining cubital. Selandriidæ: only three submarginal cells. Pamphiliidæ: prothorax not emarginate behind.

Nematidæ: abdomen not constricted at base. Cimbicidæ: antennæ clavate. Panurgidæ: first joint of feet long. Prosopidæ: no pollen brush on hind femora.

Crabronidæ: only one cubital cell. Oxybelidæ: first cubital and first discoidal cell confluent.

Philanthidæ: gaster constricted between fiirst and second segments.

Trypoxylidæ: head not wider than thorax. Thynnidæ and Scoliidæ: prothorax touching tegulæ, the latter with middle coxæ distant.

Sphecidæ: prothorax distant from tegulæ. Bembecidæ, Larridæ, Stizidæ and Nyssonidæ: abdomen sessile, the first two with but two spurs on middle tibiæ, the second and fourth with labrum concealed by clypeus.

Pemphredonidæ: but two spurs on middle tibiæ.

Eumenidæ: wings folded longitudinally. Vespidæ: claws simple.

Psamocharidæ. Marsaridæ and Sapygidæ: hind femora shorter than abdomen, the former with antennæ clavate.

APINA.

APIDÆ

The family is represented by a single introduced species, the common honey bee. There are two forms of females, the queen and the workers, the latter very rarely reaching sexual maturity, and then laying unfertilized eggs developing into males or drones. The eggs laid by the queen that produce males are likewise unfertilized. All eggs hatch in about three days; the young larvæ are given a special food secreted by the workers, for three days in the case of workers and drones, but queen larvvæ receive the royal jelly

thru the whole six days of its feeding life, a mixture of pollen and honey being fed to the others, and they do not grow so rapidly. After feeding is ended the cells are capped over with wax and the imprisoned larva spins a cocoon, pupates and finally emerges. The total time required from the de-

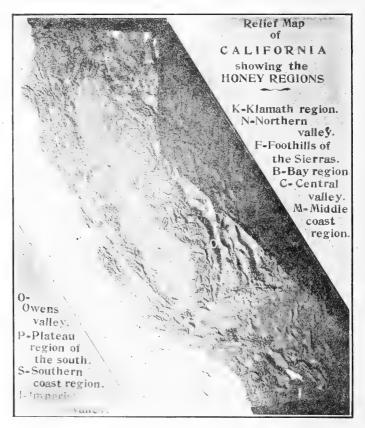


Figure 57. Relief map of California showing honey regions.

deposition of the egg to the appearance of the full grown insect is, queen 18 days, worker 21 days, and drone 24 days. Each form of bee is produced in cells of different size. Workers develop in the ordinary comb having five cells to the inch. Drone comb is similar but with about four and a half cells to the inch and in closing the cell the cap is made dome-shaped. The queen cells are made singly, have very thick and uneven walls, open outwardly, and are about half an inch in diameter and perhaps an inch long.

When a colony becomes too numerous provision is made for increase by producing and stocking with eggs a quantity of drone comb, then a variable

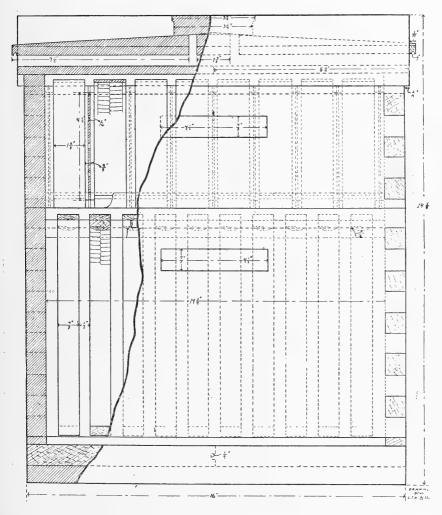


Figure 58. Details of standard bee hive.

number of quee cells are built and stocked, and as the new queens are about ready to emerge, the old queen and most of the older bees swarm forth number of queen cells are built and stocked, and as the new queens are about

tents except that each worker carries off a crop full of honey.

After the swarm adopts new quarters the workers proceed to make wax from the honey which they have eaten by massing together till the body temperature is sufficient to start secretion in the wax glands beneath the abdomen. The jaws are used as wax modeling tools.

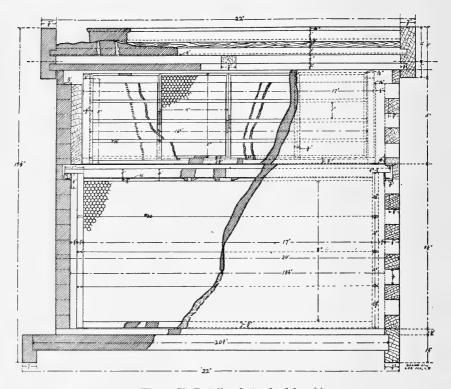


Figure 59. Details of standard bee hive.

Besides honey carried in the crop, the bees carry pollen on their hind legs and gather various vegetable gums, the propolis, used to calk the hive.

Bee keeping is a large industry in California, some producing honey by the car load. Most of the honey is extracted by centrifugal machines and sold in five gallon cans. Bees wax is a by product.

California Experiment Station Publications: Circular 63 Observation hive. Bulletin 217 Honey plants.

Apis mellifera Linn.

mellifica-mellifera.

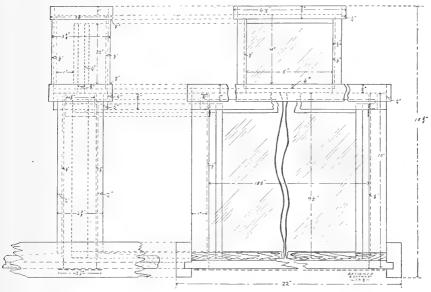


Figure 61. Details of construction of an observation hive.

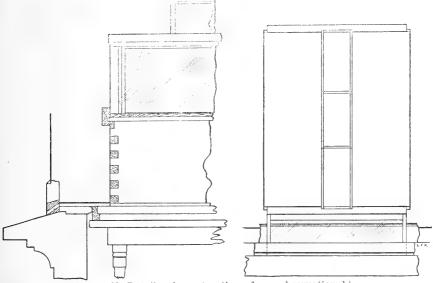


Figure 62. Details of construction of an observation hive.

BOMBIDÆ

The bumble bees are strictly social insects but the colonies only exist during the summer months. The queen makes a nest in the ground in the spring. The first workers produced are very small. When the colony becomes populous the queen ceases to forage and finally towards fall numerous drones and queens are produced, the latter after mating seek each a secluded place for hibernation. Psthyrus lives in the nests of bumble bees, and are difficult to distinguish from them. They have no worker cast.



Figure 60. Observation hive.

Aphathus californicus-Bombus. Apis fervidus-Bombus. Bombus ambiguus Fra. appositus Cr. californicus Sm. californicus-vosnesenskii. centralis Cr. columbicus-Bombus vosnesenskii. crotchii Cr. dorsalis-Bombus fervidus. edwardsii Cr. edwardsii-fernaldii. edwardsii-rufocinctus fernaldii Fra. fervidus Fabr.



Figure 63. Ceratina.

henshawi Fra. howardii-occidentalis. huntei Cr. mixtus Cr. morrisoni Cr. nevadensis Cr. nigrocinctus-crotchii. occidentalis Green. rufocinctus Cr. sitkensis Nyl. sonorus Say. suckleyi-Psythyrus. vosnesenskii Rad. Psythyrus californicus—Bombus. crawfordii Fra. suckleyi Gr.

CERATINIDÆ.

Ceratina acantha Prov. submaratima—acantha dupla Say.

gigantea Sm. pacificus Sm. tejoniensis—dupla.

NOMADIDÆ.

All of the members of this family live in the nests of other bees.



Figure 64. Nomada.

Bombomelecta edwardsi Cr. pacifica Cr. separata Cr. thoracica Pat. zygos Vier.



Figure 65. Melecta.

concavus Cr.
compactus Cr.
faciatus
nevadensis Edw.
nigroceps Sm.
occidentalis Cr.
superbus
Melecta californica Cr.

edwardsii Cr. thoracicus Cr. Nomada angelarum Co. ashmeadi Co. atrofrontata Co. ashmeadi Co. australior-edwardsii bifurcata Co. bisignata Say. californiae Co. citrina Cr. civilis (Colorada) coquilletti Co. crotchii Cr. 10-punctata Co. edwardsii Cr. elegantula Co. excellans Co. excurrens Co. flavipes Prov. formula Vier. fragilis Cr. hesperia Co humphilli Co. interrupta-interruptella interruptella Fow. latifrons Co. lepida Cr. marginella Co. melliventris Cr. nigrior-crotchii. obliquella Fow. obliqua-obliquella obscurella Fow. obscura—obscurella opposita Cr. oregonica Co. pascœnsis Co. phodosoma Co. rhodotricha Co. rivalis Cr. rubra Prov. sanctaecrucis Co suavis Cr. subangusta Co. subgracilis Co. subsimilis Co. subvicinalis Co. tintinnabulum Co. ultimella Co.

Phileremus fulviventris Cr.
vinnula (not California).
Perdita californica Cr.

claypolei Co.
interrupta Cr.
Stelis carnifex Co.

laticincta Cr. subcærulea Cr.

sexmaculata Ash.

MEGACHILIDÆ.

This family contains the leaf cutting bees, Megachile, which cut round or oval holes in the leaves of various plants, particularly roses; these are used to line their nests. Anthidium gathers cottony materials from plants for the same purpose.

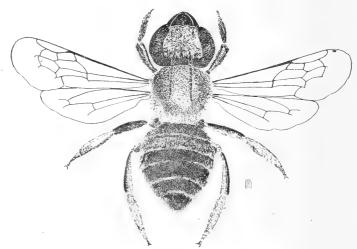


Figure 66. Leaf cutting bee, Megachile.

SYNOPSIS OF GENERA.

Osmia: pulvillus present, Chelostoma and Heriades: maxillary palpi threejointed, the latter with mandibles tridentate. Alcidamia: male antennæ deformed.

Anthidium. Megachile: second submarginal receiving both recurrents.

Anthidium. Megachile: se
Alcidamia producta Cr
Anthidium atriventris Cr.
californicum Cr.
compactum
consimile
edwardsii Cr.
emarginatum Say.
illustre Cr.
maculifrons Cr.
maculosum Cr.
pallidiventre Cr.
provancheri Tit.
tricuspidum
Chelostoma australis Co.

californicum Cr.
Heriades albicinctum Prov.
glaucum Fow.
semirubra Co.
Megachile brevls Cr.
exilis
fidelis Cr.
frigida
latimanus
montivagus Cr.
pugnata Say.
studiosa
Osmia abjecta Cr.
albiventris Cr.

armaticeps Co. atriventris Cr. brevis Cr. californica Cr. cobaltina Cr. davidsoniella Co dubia Cr. exigua Cr. lignaria Say.
manura Cr.
nigrifrons Cr.
purpurea Cr.
quadriceps Cr.
rustica Cr.
titusi Co.

XYLOCOPIDÆ.

The carpenter bees are as large as bumblebees. The female burrows into

wood making a tube several inches long which is separated into a series of cells, each for a single larva which eats pollen and honey stored by the parent.

Xylocopa æneipennis DeG. californica Cr. fimbriata Fabr. oxpifex Sm. varipuncta Pat.



Figure 67. Carpenter bee, Xylocopa.

ANTHOPHORIDÆ.

Alcyloscelis afflicta—Diadasia.
alboresta—Diadasia.
australia—Diadasia.
bituberculata—Diadasia.
cinera—Diadasia bituberculata
diminuta—Diadasia.
enavata—Diadasia.
freisei—Diadasia.
laticauda—Diadasia
nerna—Diadasia nigrifrons.
nigrifrons—Diadasia australis
opuntiæ—Diadasia australis.
rincornis—Diadasia australis.
Anthophora tricineta—Diadasia af

Anthophora tricineta—Diadasia afflicta.

abruptella Co.

anstrutheri Co.
californica Cr.
catalinæ Co.
corvicolor—infernalis.
crotchii Cr.
curta Prov.
edwardsii Cr.
exigua Cr.

flavocincta Huard. flexilipes Cr. floridana-Habropoda. ignava Cr. infernalis Dal. maculifrons—petrophila. miserabilis—Habropoda. nigrocineta-flavocineta. ornata pacifica Cr. petrophila Co. solitaria Ritz. stanfordiana Co. subtarsata-tarsata. tarsata Sick. urbana Cr. Anthophorula coguilletti-Eucera. Centris cockerelli Fox. davidsoni--hoffmansegiæ. hoffmansegiæ Co. Diadasia afflicta Cr. alboresta Prov. bituberculata Cr. cinerea-bituberculata. diminuta Cr.

enavata Cr.
freisei Co.
laticauda—Alcyloscetis.
nerea—nigrifrons.
nigrifrons Co.
nitidifrons Cr.
rincornis—australis.
tricincta—afflicta
Disiaspls olivacea Cr.
Emphoropsis interspersa Co.
opuntiæ—australis.
miserabilis Cr.
murihirta Co.
semifulva Co.
tristisima Co.
Eucera coquilletti Ash.

enavata-Diadasia. intermediella Co. intrudens-Tetralonia. lupina Cr. menucha Cr. nigrifrons Cr. obliqua olivaceae Cr. personatella Co. semilupina-menucha. smithii Dal. sternsii Co. stretchii-Tetralonia. tepida Cr. Synhalonia acerba-Tetralonia. albicans-Tetralonia.

Figure 68. Diadasia.

Habropoda depresa Fow.
floridana (Sm).
miserabilis Cr.
Macrocera pruinosa—Xenoglossa.
Macrotera californica Cr.
Mellisodes actuosa—Tetralonia.
bituberculata Cr.
californica—smithii.
catalinensis—intermediella.
edwardsii—Tetralonia.

albopillosa — Tetralonia.
californica — Tetralonia.
edwardsii — Tetralonia.
intrudens — Tetralonia.
speciosa (Colorado).

Tetralonia acerba (Cr.)
actuosa (Cr.)
albicans (Prov.)
albopillosa (Fow.)
californica (Cr.)

edwardsii (Cr.) fowleri (Co) hirsutior (Co.) iridotes (Co.) intrudens (Cr.) stretchii (Cr.) virgata (Co.) Xenoglossa angellica Co. angustior—patricia. curcubitorum (not California). davidsoni Co. patricia Co. pruinosum (not California).

PANURGIDÆ.

Amblyapis illicifoliæ Co.
Calliopsis anthidius Fow.
albitarsis Cr.
atriceps—Panurginus.
californicus—Panurginus.
cinctus Cr.
clypeatus Cr.
edwardsii Cr.
lateralis—edwardsii Cr.
visaliensis Fow.
scutellaris Fow.
zonalis Cr.
Halictoides mulleri Co.

saundersi Co.
virgatus Co.
Panurginus atriceps (Cr.)
californicus (Cr.)
chalybeus Cr.
Panurgus regularis—Parandrena.

Parandrenna albitarsis—Calliopsis.
concinnula Co.



Figure 69. Calliopsis.

enocki Co.
eumorpha Co.
regularis (Cr.)
Perdita californica
claypolei Co.
interrupta Cr.
rhois Co.
trisignata Co.

PROSOPIDÆ.

These bees carry the pollen to their nests in the honey sac and store it with a greater proportion of honey than usual. A few are parasitic. Prosopis bakeri—rudbeckiæ.

basalis Sm.
calvus Metz.
coloradensis Co.
conspicua Metz.
coquilletti—episcopalis.
cressoni Co.
episcopalis Co.
mesillæ—cressoni.
nevadensis Co.
passadenæ—cressoni.
polifelli Co.
rudbeckæ C.&S.
COLLETIDÆ.



Figure 70. Prosopis.

tridentulus Co.

These little bees live in burrows in the ground which they line with a conspicuous slimy secretion.

Colletes americanus Cr. clypeonitens SW.

ochraceus SW.

ANDRENIDÆ.

The Andrenidæ are among the smallest of the bees. They are often semi-social, many living in a common burrow but within which each maintains its own quarters.

SYNOPSIS OF GENERA.

Halictus: color not metallic Andrenna: basal vein bent.

Agapostemon. Augochlora: second recurrent from third submarginal cell.



Figure 71. Andrenna.

Agapostemon femoratus Craw.
texanus Cr.
Andrenna chalybea (Cr.)
foxii Co.
griseonigra Co
hesperidus Cr.
knuthiana Co.

perimelas Co. pertristis Co. phenax Co. stanfordiana Co. subtristis Co. Auglochora pura (Say). Chloralictus incompletus-Halictus. nevadensis—Halictus. punctativentris—Halictus. Conanthalictus bakeri—Halictus. Evylaeus latifrons-Halictus. nigrescens-Halictus. robusta-Halictus. Halictus bakeri Cra. farinosus Sm. gracilis Rob. incompletus Cra. latifrons Cra. longicornis Cra. mellipes Cra. nevadensis Cra. nigricens Cra. punctativentris Cra. purus-Augochlora. robusta Cra. Nomia nevadensis Cr. tegularis Rob. Panurgus chalybea-Andrena.

SPHECINA.

PHILANTHIDÆ.

Aphilanthops elsiæ Dun.
foxi Dun.
Cerceris æqualis Prov.
californicus Cr.
cockerelli Vier.
flavocinctus—Eucerceris.

Eucerceris flavocinctus (Cr.)
insignis Prov.
Philanthus californicus Cr.
crabriformis Sm.
subsimilis Cr.

STIZIDÆ

specius—Stlzus.
Ammatomus noneduloides (Pack.)
Gorytes monoduloides—Ammatomus.
Sphecius*convallis—speciosus.

speciosus Drury.
Hoplisoides umbonatus Cam.
Hypomellinus flavicinctis Cam.
Sphex speciosus—Sphecius.

Stizus flavus Cam . godmani Cam.

unicinctus-Stizoides. Stizoides unicinctus (Say.)

OXYBELIDÆ.

Oxybelus impatiens—quadrinotatus.

quadrinotatus Say.

NYSSONIDÆ

Astata bella Cr. cærulans Cr. nevadicus Cr. nubeculus Cr.

SPHEGIDÆ.

This family includes the mud daubers, Sceliphron and Chlorion, which store their nests with spiders, others capture caterpillars, grasshoppers, etc. Ammophila argentifrons--Psammophila Prionyx atratum--Chlorion.

luctuosa-Psammophila. sæva-Sphex.

violaceipennis-Psammophila. rightii-Sphex.

Cloptera wrightii-Sphex.

Chalybion cæruleum-Chlorion cyan-

zimmermani-Chlorion. Chlorion abdominalis (Cr.)

ashmeadii Fern. atratum (Lep.) aztecum (Saus.) bifoviatum (Tasch.)

cyaneum Dahl. elegans (Sm.) derrifineum (Fox). læviventris (Cr.)

lucæ (Saus.) pensylvanicum (Linn.)

præstans (Kohl.) rufiventris (Cr.) thomæ (Fabr.)

Isodonta aztecum-Chlorion. elegans-Chlorion.

Calmodes abdominalis-Chlorion. læviventris-Chlorion. præstans-Chlorion. rufiventris-Chlorion.

Pelopeus cementarius-Scelifron.

Ancistroma aurantia Fox. dolorosa Fox. tenuicornia Sm.

Bembidula nigrifrons (Prov) parata (Prov.) ventralis Say.

Larva tenuicornis-Ancistroma. Lyrops pepticus-Tachytes.

bifoveatum—Chlorion. ferruginium—Chlorion.

thomæ—Chlorion.
Proterosphex ashmeadii—Chlorion. lucæ-Chlorion.

pensylvanicum-Chlorion.

Psammaphila argentifrons (Cr.) luctuosa (Sm.)

pacifica Mel. violaceipennis (Lep.)

Sceliphron cementarius (Dru.) Sphex abdominalis-Chlorion.

atratum—Chlorion. aztecum—Chlorion. bifoviatum-Chlorion. cæruleum-Chlorion cyaneum. cementarius-Sceliphron.

cyaneum-Chlorion. elegans-Chlorion. ferrugineum-Chlorion. læviventris-Chlorion.

lucæ-Chlorion. pensylvanicum-Chlorion.

placidus (Sm.) præstans-Chlorion. rufiventris-Chlorion.

sæva (Sm.) thomæ-Chlorion. wrightii (Cr.)

LARRIDÆ

Microbembex monodonta (Say). Monodula nigrifrons-Bembidula. parata-Bembidula. pulchella-Stictia. pulla-Stictia. tenuicornis-Stictia. usitata-Stictia. Stictia nigrifrons-Bembidula.

parata-Bembidula. signata (Linn.) tenuicornis (Fox). usitata (Fox). Tachysphex ashmeadii Fox. crenulatus Fox. spinosus Fox. spissatus Fox.

pauxillatus Fox. Tachytes distinctus Sm. elongatus-distinctus pepticus Say. rufofasciatus Cr. Steniola duplicata Prov. scolopacea-duplicata. tibians Handl.

BEMBECIDÆ.

Bembex amœna Hal. fasciata Fabr. spinolae-fasciata. monodonta-Microbembex. nubilipennis Cr. occidentalis Fox. U-scripta Fox.

PEMPHREDONÆ



Diodontus occidentalis Fox. Mimesa mixtus (Fox). Passalœcus mandibularis Cr. Pemphredon rileyi Fox. Psen mixtus-Mimesa. Stigmus coquilletti-fulvipes. fulvipes Fox.

Figure 72. Diagram of the venation of Pemphredonidæ.

TRYPOXYLIDÆ

tridentatum Pack.

rifrons.

Trypoxylon californicum Saus. CRABRONIDÆ



Clyplochrysis gracilisimus (Pack.) nigrifrons (Cr.) Crabro abdominalis-Moniæcera. asperatus—Protothryeopus. dilectus-Protothryeopus. gracilisimus-Clytochrysus nig-

nigrifrons-Clypochrysis. packardii-Hypocrabro. sexmaculatus—Xestocrabro. spiniferus—Xylocrabro. vicinus-Thyreopus. villosus-Protothyreopus. Figure 73. Diagram of the venation of Hypocrabro packardii (Cr.) Crabronidæ.

Moniæcera abdominalis (For Moniæcera abdominalis (Fox). Protothryeopus dilectus (Cr.) villosus (Fox). Thyreopus vicinus (Cr.) Xestocrabro sexmaculatus (Say). Xylocrabro spiniferus (Fox).

VESPINA.

MUTILLIDÆ.

The females of the Mutillidæ are wingless and are often called woolly ants.

They are unusually abundant in California. Some are parasitic in bumble bee nests but the habits of most of the species are unknown. Agama rustica-Mutilla. coccinohirta Blake. unicolor-Mutilla. connectens Cr. Brachycistis brevis Fox. connectens Cr. carinatus Fox. edwardsi (Cr.) castaneus (Cr.) elevata-Cyphotes. figitiformis Bak. erudita-sackeni. gaudii Cr. glabrella-Brachycistis. grabella (Cr.) gloriosa (Saus.) inæqualis Fox. harpalyce Fox. nudus Fox. heterochroa Fox. rutilans-Cyphotes. hypermestra Fox. inconspicua-Odontophotopsis. subquadratus Fox. inconspicuus-Odontophotopsic. Cyphotes californicus Cam. elevatus Blake. indiginus Cam. infelix-Odontophotopsis inconheathii Mel. peculiaris Cr. ingenuus Cam. piceiceps Cam. spicuus. rutilans (Blake.) magna (Cr.) similis Cam. venifica (Biake). Sphærophthalma anthophoræ-Mutilnebulosa (blake). nigriventris (lower California). anthracina-Mutilla anthracicoochracea (Blake). pacifica (Cr.) Ior. arota-Mutilla. patersonæ Med. aureola-Mutilla. progne Fox. californica-Mutilla. peculiaris Cr. coccineohirta-Mutilla. testaceiventris (Fox). edwardsii-Mutilla. unicolor Cr. erudita—Mutilla. scrupea Say. gloriosa-Mutilla. tecta-gloriosa. heterochroa-Mutilla. peculiaris-Cyphotes. magna-Mutilla. progne Blake. ochracea-Mutilla. rustica (Blake). pacifica—Mutilla. pamosa—Mutilla aureola rutilans-Cyphotec. sackenii Cr. progne-Mutilla. unicolor Cr. sackeni-Mutilla. venifica (Blake.) tecta-Mutilla. zenobia (Blake). testaceiventris-Mutilla gloriosa zephritis (Fox). venifica-Mutilla. Methoca californica West. Norsyma ashmeadii Fox. zenobia-Mutilla. zephrytis-Mutilla. Odontophotopsis annulatus Bak. Glyptemetopia americana Ash. cookii Bak. Monochroa unicolor-Mutilla. exogyous Vier. Mutilla anthophoræ (Ash.) inconspicuus (Blake). anthracicolor Dal. ocellatus Bak. succineus Vier. arota Cr. Photopsis abstrusa Cam. athamas Fox. aureola (Cr.) dificilis Cam.

inconspicuus-Odontiphotopsis.

lingulatus Vier.

insignis Cam.

californica Rad.

clytemnestra Fox

castaneus-Brachycystis.

nebulosa—Mutilla. nudata Cam. pedatus Cam. rustica—Mutilla. unicolor—Mutilla.

7 HINNIDÆ

The sexes are extremely unlike in this group.

Glyphometopa americana Ash.

Thonnus californicus Pat.

Tetephromya anthrcina Ash.

TIPHIIDÆ.

Myzina rufiventris—Pterombus, ratiph:- - " bris Spin, intermedia Cam.

robusta Cam. Pterombus rufiventris (Cr.) Tiphia flavipennis Spin.

SCOLIIDÆ



Cos dives Prov.
quadricincta Prov.
Scolia consors Saus.
Trielis xantiani Saus.

Figure 74. Diagram of the venation of Scoliidæ.

MYZINIDÆ

Myzina frontalis-Plesia.

Plesia frontalis (Cr.)

SAPYGIDÆ

These insects are supposed to be parasitic on bees.

Eusapyga californica Cr.

Sapyga aculeata Cr.

angusta nevadica pumila Cr.

angustata—nevadica.

MARSARIDÆ

Euparagia scutellaris Cr. Pseudomasaris edwardsii (Cr.) Marsaris edwardsii—Pseudomarsaris

CHRYSIDIDÆ.

These insects are able to coil themselves up into a ball, the abdomen being hollowed out beneath to fit closely against the underside of the head and thorax. They are parasitic in the nests of other wasps.

Chrysis alfkenella DuB. californica Gril. cœrulans Fabr. densa Cr. dorsalis Aaron,

halictula Gril.

hilaris Dahl. inflata Aaron. intricata Brul. inusita Aaron. lauta Cr. opyima Aaron. mucronata-parvula. pacifica Say. parvula Fabr. perpulcra Cr. propria Aaron. verticalis Pat.

Cleptes purpurata Cr. Ellampus marginatus (Pat.) nitidus(Aaron).

Euchrœus edwardsii-Parnopes. Hedychordum continuum Sr.

Hedychridium cintinuum-Hedychor- Omalus diversa Aaron. dum.

continuum Aar. dimidiatum-Holopyga. viride-Holopyga.

Hedychrum dimidiatum-Holopyga.

sinuosum-Omalus. ventralis-Holopyga. violaceum Brulle.

viride-Holopyga. Holochrysis interfota DuB. Holopyga dimidiatum (Say).

ventralis (Say). viride (Cr.)

Notozus marginatus-Ellamus.

nitidus-Ellampus. læviventris Cr.

sinuosus (Say). Parnopes edwardsii Cr. Spintharis annulipes Mocs

EUMENIDÆ.

This and the next family fold their front wings when at rest. These are solitary wasps which store caterpillars in their nests.

Ancistocerus edwardsii-Odynerus.

lalophila Vier. fulvitarsis Cam. lineativentris Cam. rivularis-Odynerus. sutterianus-Odynerus. trichiontus Cam. Eumenes coloradensis Cr.

crucifera Prov. Monobia bicolor Prov. Nortonia nevadensis Cam. Odynerus blandus Saus.

claremontis Cam.

cytainus Cam. cosmiogaster Cam. edwardsii Cam. fulvitarsis Cam. philadelphiæ Saus. pratensis Saus. rivularis Cam. scutellaris Saus. sulfureus Saus. sutterianus Saus.

Pterochilus biplagiatus Cr. Symmorphus philidelphiæ-Odynerus.

VESPIDÆ.

Paper wasps so named because their nests are made of paper manufactured by the insect. The yellow-jackets h ave a very similar history to that given for bumble bees. Hornets make their nests above ground and have equally populous colonies.

SYNOPSIS OF GENERA.

Vespa. Polistes: abdomen only subsessile. Polybia: abdomen petiolate

Polistes anaheimensis—aurifer.

aurifer Saus. minor Beauv. navajoe Cr.

Polybia flavitarsis Saus.

Vespa diabolia Saus. germanica Linn. maculata Fabr.

occidentalis-germanica.

sulphurea Saus.

PSAMOCHARIDÆ.

The tarantula hawks, Pepsis, are the largest members of the order. All of the species of the family are supposed to store their nests with spiders.

Agenia blaisdelii Fox. Arachnoproctonus ferrugineus (Say.) Ceropales. ferrugineus-Arachnoproctonus.

fraterna Sm. stretchii Fox. Pepsis chrysothemis Luc. cinnabarina Luc. formosa (Say.) hesperiæ—mildei Stal. sommeri Dahl. Planiceps planatus Fox.

Pompilius ferrugineus—Arachnoproctonus.

formosus—Pepsis.

tenebrosus—Pycnopompilius.

Pycnopompilius tenebrosus (Cr.)

FORMICINA.

FORMICIDÆ.

The ants are of peculiar interest at the present time in California because of the recent introduction and steady spread of the Argentine species, Iridomyrex humilis, which is killing off all native ants and proving a very serious annoyance about the house. Already the insect occupies all of Alameda and the greater part of San Jose and College Park, and also large areas in Los Angeles, Berkeley, and Stockton. It is present in numerous other localities.

Ants are social insects with a wingless worker cast and queens that lose their wings after their nuptual flight..

Literature: — California Bulletin 207.

Aphenogaster paturellis Forel.

pergandei Mayr.
Camponotus anthrax Whe.
fallax Nyl.
herculeanus Linn.
hyatti Emery.
lævigatus Sm.

Figure 75. Diagram of the venation of Formicidæ.

maccooki Forel.
maculatus Fabr.
Cremastogaster lineolata Say.
vermiculata Emery.
Cyphomyrmex wheeleri Forel.
Dorymyrmex bicolor—pyramicus.
pyramicus Roger.
Echiton californicum Mayr.
Formica pilicornis Emery.
rufa Linn.
rufiventris Emery.
subpolita Mayr.

Wheeler, Ants.

tejonia Bick.
Iridomyrmex analis And.
humilis Mayr.
Leptothorax andrei Emery.
nitens Emery.
pergandei And.
Liometopium apiculatum Mayr.

microcephalum Panz. Messor andrei Mayr. pergandei And.

stodderdi Emery. Monomorium ergatogyna—minutum minutum Mayr. pharionis Linn.

Myrmecocystis lugubris Whe. melliger Forel. mexicanus Wesm.

Myrmica bicarinata. Nyl. bradleyi Whe. californicus Buck.

Phiedole barbarata Whe. californica Mave hyatti Emery.

Neoponera agilis For.
Pogonomyrmex badius Latr.
barbatus Sm.
californicus Buck.
occidentalis Cr.
subdentatus Mayr.

Plenolepis imparis Say. Solenopsis aurea Whe. geminata Fabr. texana Emery. Stenamma bakeri Whe. brevicorne Mayr. nearcticum Mayr. patruelis—bakeri. Tapinoma sessile Say.

STACES OF THE ARGENTINE ANT. - Iridomyrmex humilis.



Figure 76. The Egg.



Figure 78. Older larva.

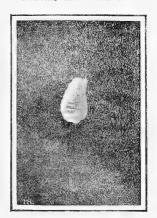


Figure 77. Young larva.



Figure 79. Pupa.

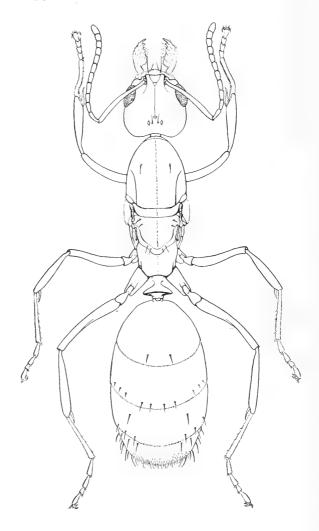




Figure 86. Queen of the Argentine ant, Irilomyrmex humilis.

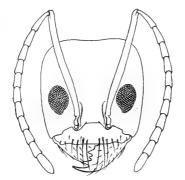


Figure 81. Head of Dorymyrmex

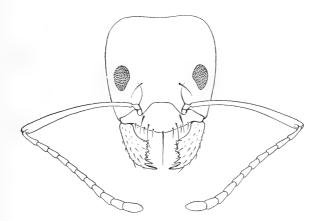
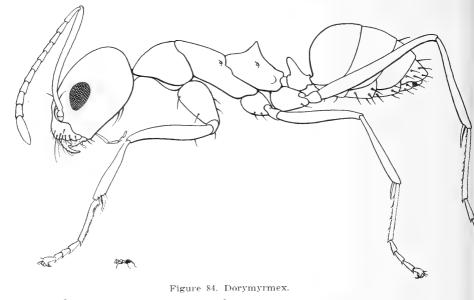


Figure 82 Head of Iridomrymex analis.



Figure 83 Queen of the Argentine ant.



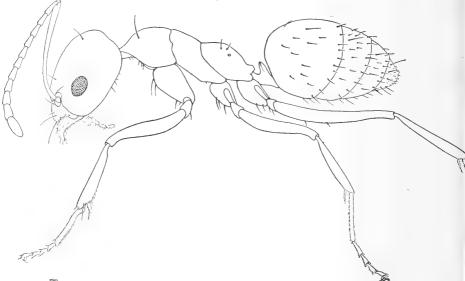


Figure 85 Iridomyrmex analis.

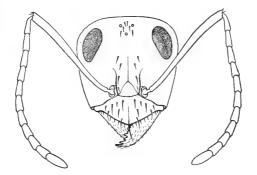


Figure 86. Head of a queen field ant, Formica.

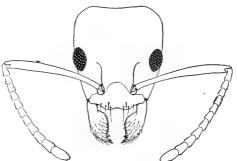


Figure 87. Head of Tapinoma.

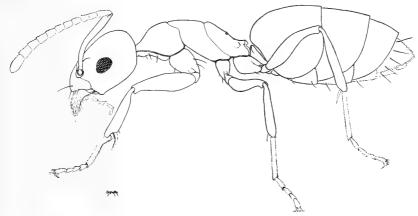


Figure 88 Tapinoma.

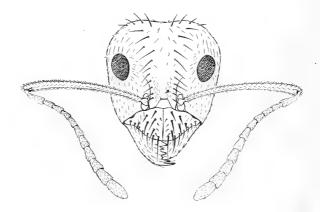


Figure 89. Head of the smaller honey ant, Prenolepis.

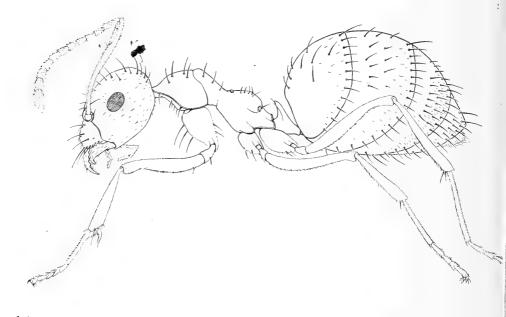
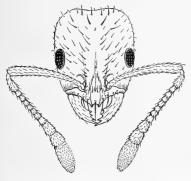


Figure 90. The smaller honey ant.



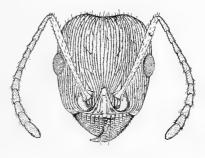


Figure 92. Head of the black harvester ant.

Figure 91 Head of small house ant. Stenamma.

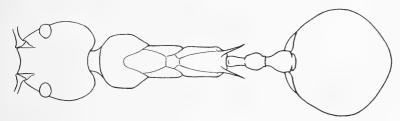


Figure The back of the black harvester ant

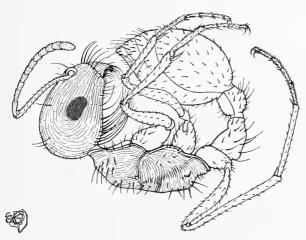


Figure 94. The red harvester ant. Pogonomyrmex. Position assumed when greatly annoyed.

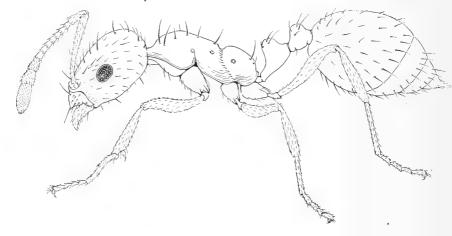


Figure 95. Small house ant, Monomorium.

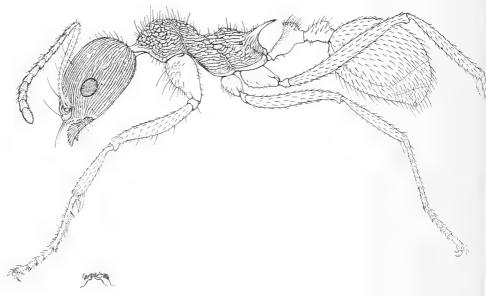


Figure 96. The black harvester ant,

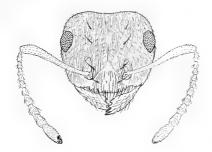


Figure 97. Head of acrobat ant, Cremastogaster.

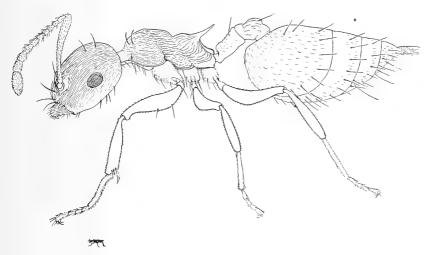


Figure 98. The acrobat ant..

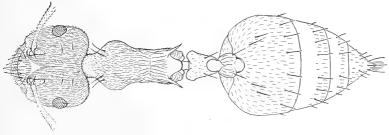


Figure 99. The back of the acrobat ant.

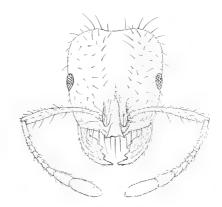
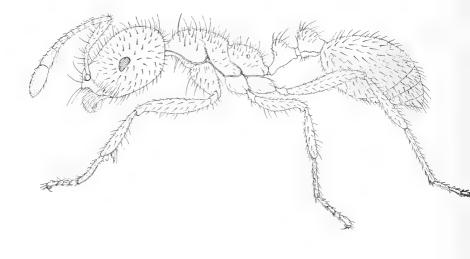


Figure 100. Head of the fire ant, Solenopsis.



1990 AU

Figure 101. The fire ant.

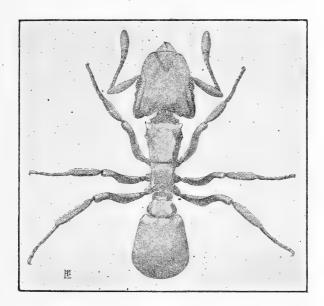


Figure 102. The fungus ant, Cyphomyr



Figure 103. Side view of the fungus ant.

CHALCIDINA.

EULOPHIDÆ.

Aphelinus diaspidis How.
flaviceps How.
fuscipennis How.
mytilaspidis Leb.
Aspidiotiphagus citrinus (Craw).

Coccophagus aurantii—Prospalta.
californicus How.
citrinus—Aspidiotiphagus.
flavoscutellum Ash.
lecanii Fitch.

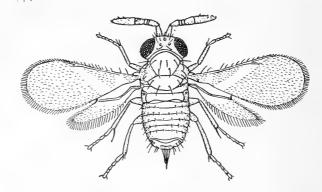


Figure 104. Aphelinus diaspidis.

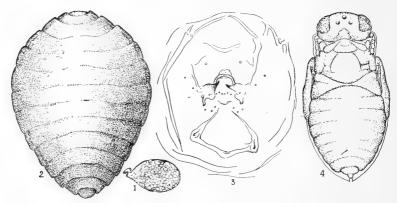


Figure 105. Aphelinus diaspidis. 1. egg.2. larva. 3. head segment. 4. pupa.



Figure 106. Aspidiotiphagus citrinus.

lunatus How.
ochraceus How.
scutatus How.
Encarsia angelica How.
coquilletti How.
Eretmocerus californicus How.

Gyrolasia flavimedia—Pteropteryx. Prospalta aurantei (How.) Prospeltella gelatinosus Horn. quericola How. Pteropteryx flavimedia (How.) Tetrastichus californicus Ash.

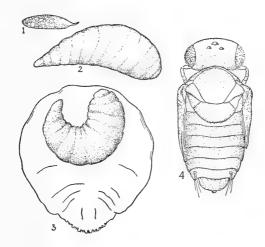


Figure 107. Aspidiotiphagus citrinus. 1. egg. 2. larva. 3. larva in yellow scale. 4. pupa.

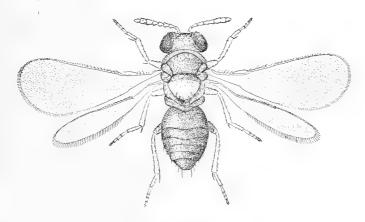


Figure 108. Coccophagus lunatus.

CLEONIDÆ.

Enchrysia hyalipennis Ash.

maculipennis Ash.

PTEROMALIDÆ.

Epsitemia odeyneri Halizoa rufipes Ash. Isocratus vulgaris Metapon californicum **Ash.**

ENCYRTIDÆ.

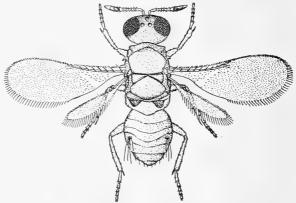


Figure 109. Aphycus flavus.



Figure 120. Soft brown scale with exit holes of Aphycus flavus.

Bothriothorax californicus How.
Aphycus angelicus How.
californicus How.
coquilletti Howfiscipennis How.

flavus How.
immaculatus Hiw.
lecanii How.
nigritulus How.
Blastotrix yuccæ Cog

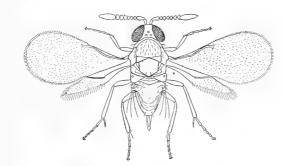


Figure 121 Aphycus immaculatus.

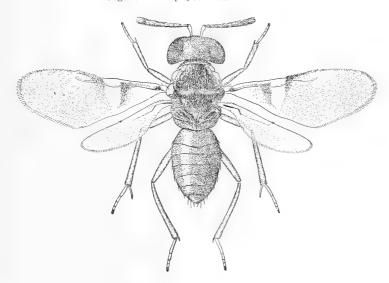


Figure 122. Comys fusca.

nigripes How.
planifrons How
rotundatus How.
Calogaster longiventris Ash.
Cerchysius hubbardi Ash.
Chrysoplatocerus splendens How.

Comys fusca How.
Encyrtus dubius—Microterys.
flavus—Microterys.
Isodromus iceryæ How.
Microterys dubius (How.)

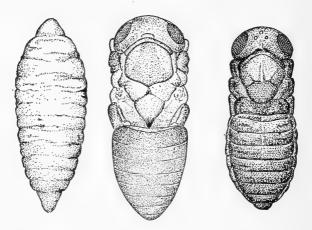
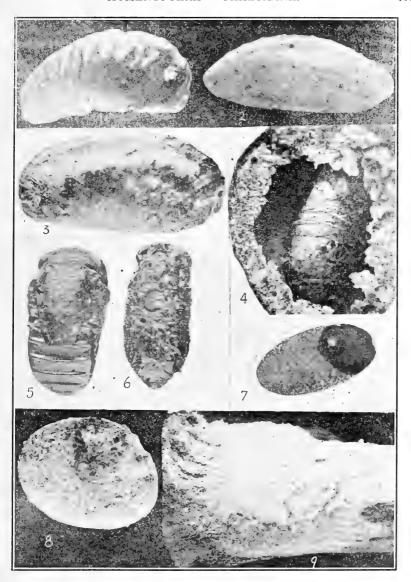


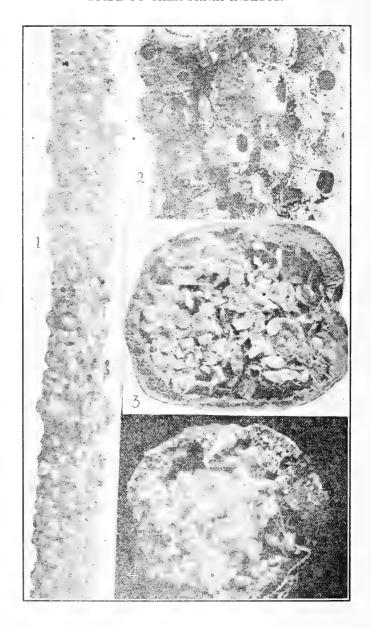
Figure 123 larva of Comys fusca, pupa of Comys fusca and pupa of Coccophagus lunatus.



Figure 124. Microterys flavus.

Figure 125. (Opposite page.) Hyperparasite of Scutellista. 2. the same changing to pupa. 3. Scutellista larva containing hyperparasite the same beneath the scale. 5. normal pupa of Scutellista. 6. parasitized pupa. 7. exit hole of parasite in old larva skin of scutellista. 8. black scale killed by a fungus, Isaria. 9. fungus covering scale and spreading over twig.





flavus (How.)
Physcus varicornis How.
Tineobius californicus Ash.
coquilletti Ash.
occidentalis How.

Tanaostigmodes howardii Ash. tychii Ash. Rhipodens citrinus How. Signiphora australiensis Ash. Prospalta aurantii How.

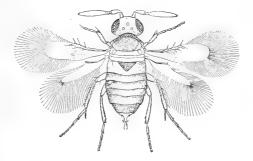


Figure 127. Signiphora occidentalis.

FIGITIDÆ.

Eucoila minor Prov.

MISCOGASTERIDÆ.

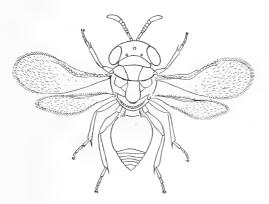


Figure 128. Dilophogaster californica.

Figure 126. (Opposite page.) 1. black scale with exit holes of Scutellista. 2. the same more enlarged. 3. young black scale which died without emerging from the parent scale. 4. eggs and young scale killed by fungus, Isaria.

Brasema ruficollis Cam. Dilophogaster californica (How.) Semiotellus destructor How. Tomocerus californicus—Dilophogaster

EUCHARIDÆ.

Chalcura californica Ash. Lophyricera apicalis Ash. Orasema occidentalis Ash.

EURYTOMIDÆ.

This family comprises the only group of injurious Chalcidina. The members of the principal genus, Isotoma, are known as joint worms. They feed as larvæ in the stems of wheat and other grasses.

Decatomidea cooke How-Eurytoma californica Ash. tritici—Isotoma. Isotoma agrostidis How. bromicola How. californicus How. grandæ Ril. hirtifrons How.
tritici Fitch.
Orasema occidentalis Ash.
TORYMIDÆ.
Megastigmus pinus Par.
Monodontomerus montivagus Ash.
Syntomaspis californica Ash.

AGAONIDÆ.

The one species of this family was imported a few years ago to fertilize the smyrna fig which previously would not bear fruit. The pollen is produced in the capra variety, and in the figs of that variety the insect comes to maturity. The male is wingless and remains within the fig within which it was born. The female after being fertilized, escapes and carries the pollen with which she is dusted to a young fig, fertilizing it.

Blastophaga grossorum Grav.

MYMARIDÆ.

Anaphes cinctiventris Gir.

Gonatocerus californicus Gir.

PROCTOTRYPINA.

PROCTOTRYPIDÆ.



Figure 129. Diagram of the venation of Proctotrypidæ.
Acerota cecidomyidæ Ash.
Aclista californica Ash.
rufescens Ash.
Alapatus eriococci Ash.
Amblyaspls californicus Ash.

Anectata californica Ash.
Balays californica Ash.
Ceraphron californicus Ash.
salicicola Ash.
Cinetus californicus Ash.
colon Ash.
muscæ Ash.
Dissomphalis californicus Ash.
Epyris longicollis Kief.
occidentalis Ash.
megacephalis Ash.
Gonatopus californicus Ash.
Goniocus cellularis Say.

Ampulicomorpha confusa Ash.

Hadronotus largi Ash.
Hemilexus californica Ash.
Inostemma californica Ash.
Loxotropa californica Ash.
Lygocerus californicus Ash.
niger How.
pacificus As.

Negaspilus californicus Ash. Nesitus californicus Ash. Pantoclis californica Ash. montana Ash.

Paramesius pallidus Ash. Pentacantha rufitarsis Kief. Phænipria montana Ash. Polygnotus atriplicis Ash.

artemisiæ Ash. californicus Ash. eurotiæ Ash.

Pelicinus polyturator Dru.

hauchucæ Ash.
salicicola Ash.
striaticeps Ash.
Polymecus lupina Ash.
Proctotrupes californicus Ash.
caudatus Say.
pallidus Say.
Prosocantha californica Ash.
Sparasion pacificum Ash.
Telemonus californicus Ash.
clisiocampæ Ash.
gnophælæ Ash.
koebelei Ash.

Thoron opacus Ash.
Trichopria pacifica Ash.
Trichosteresis floridanus Ash.
Zelotypa ashmeadiMetz.
Zygota californica Ash.

PELECINIDÆ.



Figure 130. Diagram of the venation of Pelecinidæ.

ICHNEUMONINA.

EVANIIDÆ.

Aulacus editus—Odontaulacus.
rufitarsis—Odontaulicus.
Evania californicus—Evaniella.
Evaniella califorica Ash.
Fœnus occidentalis Cr.
rubrofasciatus Kief.
visaliæ Brad.
Gasteruption pattersonæ M. & B.
pyrrhosternum Kief.
rubrufasciatum Kief.

rubrufasciatum K Hyptia fulchi Ash. Odontaulacus editus Cr. rufitarsis Cr.



Figure 131. Diagram of the venation of Evaniidæ.

Pristaulacus fusculatus Brad.

ICHNEUMONIDÆ.

Agrypon puparum Ash.
Amblyteles montanus Cr.
subfuscus Cr.
Anderis californicus Cr.
Anomalon californicum Cr.
eurekæ Ash.
maceratum Cr.

simile Ash.
verbosum Cr.
xanthopis Ash.
Aperileptus tropicus Day.
Atmetus californicus Ash.
Bassus cinctus Cr.
cinctulus—orbitalis.

decoratus—Homotropus.
euuræ—Holmgrenia.
humeralis—Homotropus.
maculifrons—Syrphoctonus.
orbitalis Ash.
pacificus—Syrphoctonus.
pleuralis—Syrphoctonus.
syrphicola Ash.
xanthopsis—Syrphoctonus
cificus.
purgatum Say.

purgatum Say.

Brephactonus californicus Ash.

Campoplex assitus Nort.

Corinæus californicus—carinatus.

carinatus (Cr.)

Campsocryptus brevicornis Cam.
Charops fuscipennis Prov.
Clepsiporthus subiginosus (Cr.)
Cremnodes californicus (Ash.)
tuberculatus Ash.
Cryptus alamedensis Ash.

Figure 132. Diagram of the venation of Ichneumonidæ.

californicus Ash. callipterus Say. crotchii Cr. dirus Cr. edwardsii Cr. ferrugineus Ash. pacificus Cr. perplexus Cr. proximus Cr. punicus Cr. purpuripennis Cr. resolutus Cr. tejonensis Cr. turbatus Cr.

turbatus Cr.
Cteniscus californicus Cr.
excelsus—Exyston.
Enytus maculipes Cam.
Epachthes basilicus Dav.
Eremotylus arctiæ Ash.
Eriborus triannulatus Cam.
Erromenus crassus (Cr.)
glabrosus Dav.
obscurellus—Monoblastus.

maculipennis Ash. Eupalmus piceus Ril. Eurythrocryptus rufus Cam. Exetastus maurus Cr. zelotypus Cr. Exachus atricoxalis-Exochus lævis-Netacœlus. pa- Exochilum acronyctæ Ash. glabrosus Dav. occidentalæ Cr. Exochys atricoxalis Cr. glabrosis Dav. Exotylus gelechiæ Ash. Exyston excelsus (Cr.) politus Dav. Glypta californica Prov. macra Cr. Grotea californica Cr. Hemiteles annulatus ashmeadii Ril. coleophoræ Ash. meliteæ Ash. Boethus alaingens Dav. variegatus Ash. Heteropelma longipes Prov. Holmgrenia euuræ (As.h) Homotropus decoralus (Cr.) humeralis (Prov.) Ichneumon astutus Holm. californicus-rufiventris. clairmontis Cam. crudosus Cr. cupitus Cr. curvator-Triclistus. difficilis Cr. infractus Cr. leucopsis Ash. longulus Cr. neutralis Cr. nuncius Cr. odiosus Cr. petulcus Cr. purpuripennis Cr. rufiventris Br. semisissis Cr. variegatus Cr. Ictoplectis orgyiæ Ash. Ischyrocnemis pacificus Ash. Itaplectus orgyiæ Ash. Lampronota hilaris Cr.

ocidentalis Cr.

Limneria californica Cr.

eureka Ash.

cupressi Ash.

Euchrysia hyalinipennis Ash.

fugitiva Say.
nolæ Ash.
pterophoræ Ash.
tibiator Cr.
Limnoceras edwardsii Cr.
Mesochorus irridescens Cr.
Mesoleius rubiginosus—Clepsiporthus
scapularis (Cr.)
stretchii—Œthophorus.

Œthophorus stretchii Cr.
Ophion arctiæ Ril.
palmaris Dav.
costale Cr.
emarginatus—Tapinops.
nigriceps
Orona petiolaris Cam.
OrtLocentris californicus—Tapinops
emarginatus.

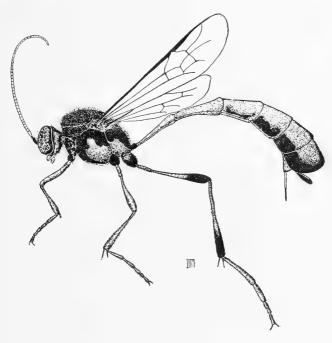


Figure 133. An Ichneumon fly.

submarginatus (Cr.)
Mesotenus gragilipes Cr.
Mesochorus iridescens Cr.
Mesoleptus scapularis—Mesoleius.
Metapodius montanus Cr.
Metapon californicus Ash.
Metapodius montanus Cr.
Monoblastsus obscurellus (Cr.)
Monoblastus obscurellus (Cr.)
Nœmon californicus (Cr.)
lusoris (Cr.)

Orthopelma cammicum Ash.
Otacustes nigroornatus Cam.
Orthoporus innumerabilis Dav.
Pezomachus californicus Ash.
niger Prov.
Phygadion albirictus Cr.
californicus Cr.
crassipes Rov.
fulvescens Cr.
litamus Cr.
phryganidiæ Ash.
Phytodictus californicus Cr.

obscureilus Cr. Pimpla annulipes Brul. aplopappi Ash. behrensii Cr. brunneifrons Vier. conquisitor Say. erythropus Vier. lithocolletidis Ash. notanda Cr. orgyiæ Ril. pterophoriAsh. rubropectus Cr. Polyblastus pedalis (Cr.) Polysphincta koebelei How. Platylabrus californicus Cr. consors Cr. Porizon californica Prov. Pristomerus pacificus Cr.

Schletterius cinctlpæ (Cr.)

Adelura subcompresa Ash. Alysia fossulata Prev.

Apanteles koebelei Ril. Aphidaria basilaris Prov. Aphldus californicus Ash. confusus Ash. lachni Ash. nigrovarius Prov. Blacus atricornis Ash. orchesiæ Ash. californicus Ril. cecidomyiæ Ash. Bracon angelicus Prov. atripectus Ash. euuræ Ash. juglandis Ash. koebelei Ash. nevadensis Ash politus Prov. sanguineus Prov. xanthonotus Ash. Cænophanes koebelei Chelonus fissus Prov. irridescens Cr. nanus Prov. Eubadizon californicus Prov. Ganychorus atricornis Ash. orchesiæ Ash. Heterospilis koebelei Ash. Lipoplexus chenipodiaphidis Ash. piceus Ash.

Stenomacris hastatus Dav. Syrphoctonus maculifrons Co. pacificus Cr. pleuralis (Cr.) Stiboscopus erithrostomus Cam. Tapinops emarginatus (Say). Thibetoides flosimoris Dav. Triclistus curvator Fabr. Triphon californicus-Næmon. carinatus-Chlorinasus. communis Cr. lusorius-Næmon. pedalis-Polybiastus. submarginatus-Mesoleius. subniger Cr. tejonicus-Syrphoctonus crassus Xylonomus californicus Cr. Zaglyptus koebelei-Polysphincta.

STEPHANIDÆ.

Stephanis cinctipae-Schlettarius.

ALYSIIDÆ.

Aphæreta californica Ash.

BRACHONIDÆ.



Figure 134. Diagram of the venation of Brachonidæ.

rapæ Curt. salicaphidis Ash. Lisiphlebus abutilaphidis Ash. baccharaphidis Ash. citraphis Ash. coquilletti Ash. eragrostaphidis Ash. persicaphidis Ash. piceiventris Ash. Macrocentris aciculatus Prov. Meteorus coquilletti Ash. Microdus bicolor Prov. Porilitis coqualetti-Metorus. Proterops californicus Ash. Chogus ceruræ Ash. Rhysalus californicus Ash. Spathius sequoiæ Ash. pluto Ash. Toxoneurus californica Ash.

CYNIPINA.

CYNIPIDÆ.

This family comprises gall making insects and their guests (inquilines).

The food plants are **Rubus** Diastrophus, **Rosa** Rholites and Lytorhodites, **Quercus** all other species. The oak galls occur on various parts of the tree as follows:— roots Callirhytis, twigs Disholcaspis, Cynips all species except maculipennis, Andricus quercuscalifornicus, dasydactyli and wisliceni, Callirhytis, chrysolepidicola, quercuspomiformis, quercussuttoni, nigra and santæclaræ. staminate flowers Diplolepis dubiosa and Andricus congregatus. buds Andricus pacificus and viltzæ Callirhitus maculipennis, eroiphora, clarimontis, bakeri and rossi. leaves all other species The inquilines are known chiefly on the galls of Holcaspis eldoradensis and Callirhytis quercuspomiformis.

Andricus chrysolepidis Ash.

agrifoliæ—Callirhytis quercusagrifoliæ. apicalis—Callirhytis. brunneus Ful. californicus (Bas.) chincopin (Fitch). chrysolepidis Ash.

chrysolepidis Ash. chrystallinus Bas. congregatus Ash. crystallinus Bass. dasodactyli Ash.

kingi Ash. kingi Bas. pacificus Ash.

parmula Bas. pattersonæ Ful. pompiformis (Bas.)

quercus agrifoliæ—Callirhytis. quercus californicus (Bas.)

quercusplocci (Walsh.) quercuspomiformis—Callirhytis. quercussuttoni—Callirhytis.

speciosus Bas. suttonii—Callihritis.

viltzæ Ful. wisliceni Ash.

Biorhiza californica Beut. Callirhytis agrifoliæ (Bas.) Callirhytis apicalis (Ash.)

bakeri Kief.
clarimontis Kief.
chrysolepidicola (Ash.)
eriphora Kief.
eriophora Kief.

guadaloupensis Ful. lasia Ash. maculipennis Kief. nigra Ful.
polythyra Kief.
pomiformis—quercuspomiformis.
quercusagrifoliæ (Bas.)
quercuscalifornicus—Andricus.
quercuspomiformis (Bas.)

quercussuttoni (Bas.)

Figure 135. Diagram of the venation of Cynipina.

rossi Kief. santæclaræ Ful. suttoni (Bas.) vaccinifoliæ Ash. niger Ful.

Ceroptres pompinormis As...
dorsalis Prov.

Compsodryoxenus brunneus Ash. Cynips agrifoliæCallirhytis quercusagrifoliæ.

agrifoliæCalliorhytis quercusagbicolor—Rhodites.

californicus—Andricus quercuscalifornicus.

canescens (Bas.)
chrysolepida—Callirhytis.
chrysolepidocala—Andricus.

corallina (Bas.)

cuspomiformis. echina-Diplolepis. heldæ Full. kelloggi Full. multipunctata (Beut.) maculipennis (Gill.) oneratus-Synergus. pompiformis-Callirhytis .querquercus-Andricus californicus. quercusagrifoliæ—Callirhytis. quercusbattatus-Neuroterus. quercuscalifornicus—Andricus. quercusflocci—Andricus. ... quercuspomiformis—Callirhitis. quercussuttoni—Callirhytis. . rifoliæ. saltatorius-Neuroterus. suttoni-Callirhytis. tenuicornis Bas. quercusechinus — Diplolepis chinus. quercus-Andricus quercuscali- Synurgus agrifoliæ Ash. fornicus. saltatorius—Neuroterus. suttoni-Callirhytis quercussuttoni. Diastrophus kincaidi Gil. corallina-Cynips. Diplolepis clavula (Beut.) discus (Bas.) echina (O.S.) douglasi (Ash.) dubiosa Full. Disholcaspis chrysolepidus (Beut.) eldoradensis (Beut.) Dryophanta clavula-Diplolepis.

multipunctata-Cynips. Figites chincopin-Andricus. Holcaspis canescens-Trichoteras. chrysolepidis-Disholcaspis. corallina—Cynips. douglasi—Diplolepis. eldoradensis—Disholcaspis. maculipennis—Cynips. truckeensis-Disholcaspis. Lytorhodites arefactus Ash. Neuroterus fragilis Bas. quercusbattatus (Fitch.) saltatorius (Edw.) piceus Full. terminalis Hartig. Periclistus californicus Ash. obliquus Prov. brevicornis As ... flavus Kief. e- Rhodites bicolor (Har.) politus Ash. dimorphus O.S. dubicsus Full. maculatus Full. multiplicatus Ful. niger Ful. ochreus Ful. oneratus (Harr.) punctatus Gill. splendidulus Ful. varicolor Ful. Trichoteras coquilletti Ash. ovalis Lec. nanus Lec. koebelei OII.

SIRICINA.

These insects, known as horn-tails, burrow as larvæ into the trunks of trees thus injuring the lumber. The common name of the group refers to a peculiar process at the end of the abdomen in larva and pupa as well as in the adult.

CEPHIDÆ.

Cephus clavatus (Nort.) rufiventris Cr.

discus-Diplolepis.

Phyllecus clavatus-Cephus.

ORYSSIDÆ.

Oryssus thoracicus Ash.

SIRICIDÆ.

Sirex areolatus (Cr.)
californicus (Ash.)
cyaneus—juvenalis.
juvenalis Fabr.
Paururus californicus—Sirex.
Urocerus albicornis—californicus.
areolatus—Sirex.

areolatus—Sirex.
behrensii—Sirex.
californicus Nort.
caudatus—Xeris spectrum.
morrisoni—Xeris.
Xeris morrisoni (Cr.)
tutatrix Fitch.

erythrocephala Banks.

Figure 136. Diagram of the venation of Siricina.

TENTHREDININA.

CIMBYCIDÆ.

Abia americana (Cr.) Trichiosoma lanuginosa Nort. Cimbex rubida Cr. Zaræa americana—Abia.

SELANDRIIDÆ.

Tenthredo cerasi-Eriocampa.

DOLERIDÆ.

sericeus Say.
tejonensis (Nort.)
posytheus tejoniensis—Dolerus.

TENTHREDINIDÆ.

Aphanius lenis Roh. Allantus annularis Nort. basilaris Say interruptus Nort. limbatus Cr. Claremontia typica Roh. Hylotoma cœrulea Marl. Labida doanei Roh. Macrophya bicolorata Cr. californica (Nort.) fumator Nort. jugosa Cr. napiensis Roh. pieuricincta Nort. pumila Nort. subviolacea Cr.

Eriocampa cerasi (Peck).

Dolerus coccinifera Nort.

parvuila Cr.

cookii Ularke.

distinctus Nort.

Selandria cerasi-Eriocampa.

Pereclista leucostoma Roh. Pleuroneura californica Ash.

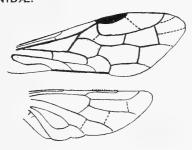


Figure 137. Diagram of the venation of Tenthredinina.

Strongylogaster distans Nort. fidus Cr.

Tenthredo addenda Cr.
(atlantus—flavomarginis.
californicus—Macrophya
diluta Cr.
edwardsii Cr.
flavomarginis Nort.

fumipennis Nort. lateraria Cr. obscuripennis Nort. parvula Cr. variata Nort. varipicta Nort.

NEMATIDÆ.

The best known member or the family is the gooseberry sawfly Pteronus ribesii Scop. which does not occur west of Missouri. Our P. thoracicus has been bred from Amelanchier canadensis. The smaller genera may be distinguished as follows:

Gymnononychus: claws simple. Pristophora: claws with a short tooth. Pontania: length not over 5.5 m.m. Amauronematus: mesonotum and pleuræ opaque.

Pontania produce the common conspicuous galls on willow leaves and Gymnonynchus is our pear sawfly.

Monograph: - Marlatt, Bull. U. S. Ent. Tech. ser. 3.

Amandonematis californicus Marl. coquilletti Marl. Gymnonynchus californicus Marl.

Nematus edwardsi—Pteronus. erithrogaster—Pteronus.

iridescens—Pteronus.
mendicus—Pteronus
pava—Pontania.
singularis—Gymnonychus.
thoracicus—Pteronus.
trivitata—Pteronus mendicus.
vertebratus—Pteronus.

vicinalis—Pteronus.
Pontania californicus Marl.
excavatus Marl.

nevadansis (Cr.) pacifica Marl.

parva (Cr.) resinicola Marl. truncata Marl.

Pristophora siskyouensis Marl. Pteronus californicus Marl.

edwardsii (Cr.)'
erithrogaster (Nort.)
irridescens (Cr.)
koebelei Marl.
mendicus (Walsh).
occidentalis Marl.
thoracicus (Har.)
unicolor Marl.
vancouverensis Marl.
vertebratus (Say).
vicinalis (Cr.)

HYLAMTOMIDÆ.

Hylatoma cœrulea Nort. Schizocerus crawii (Prov.) Sphacophilus crawii-Schizocerus.

LOPHYRIDÆ.

ophyrus edwardsi Nort.
PAMPHILIIDÆ.

yda bucephalis—Pamphilius.
pacificus—Pamphilius.
verticalis—Pamphilius.

Pamphilius bucephalus (Cr.)
pacificus (Nort.)
verticalis (Cr.)
caudatus Nort.
nigricornis Nort.

DIPTERA.

The term fly has come to signify a member of the order Diptera, tho in combination the name is used in most of the orders, as sawfly, butterfly, greenfly, whitefly, dragonfly, mayfly, etc. The most constant distinguishing characteristic is the structure of the hind wing, which is a short slender knobbed appendage called the halter, often covered and partly concealed by a lobe of the front wing. When the front wings are absent the halters also disappear.

The mouth parts are extremely variable, sometimes all the parts are present



Figure 138 Wing of the house fly.

but with mandibles and maxillæ modified into piercing organs and the epipharynx and hypopharynx may be developed into additional lancets, the labium which is always without palpi forming a sheath enclosing all the lancets. In the majority of flies the mouth is more or less simplified by the reduction or suppression of parts and in a few cases the whole mouth is rudimentary. The labium remains relatively large in all functional mouths. The one to five jointed maxillary palpi present the most characters of systematic value in the varying number size and shape of the joints

The antennæ show a great range of structure, being comparatively simple and many jointed in the lower forms, but the higher flies have the third joint enlarged and variously modified and the remaining joints reduced often

appearing as a simple bristle on the side of the third joint.

The venation affords the most important characters used in classification. Great diversity occurs. The marginals are usually well developed, sometimes continuous around the wing. The anterior marginal is often called the costal. The primary usually has three branches, the third being sometimes forked.

The independent vein divides the two basal cells and encloses the discal cell, the large or posterior cross vein closing it externally. The small or anterior cross vein connects with the primary closing the first basal cell and the posterior basal cross vein connecting with the posterior vein closes the second basal cell. There are usually two posterior veins enclosing the third basal or anal cell. The open cells beyond the basal cells are called the posterior cells the first being opposite the first basal.

A system of formulæ has been devised constructed by listing the bars of the discal cell in the order of their size, numbering them outwardly in order using the even numbers below. The following list includes most of our ganera of crane flies.

3 6 7 (1 2 4) 5* Amalopsis. 1 - 21Bittacomorpha. 3 1 4 (2 5* 6) Ctenophora. $1 - 2 \ 3 \ 1 \ 5 - 3 \ 4 \ 1 \ 6 \ 5 \ 2$ Dicranomyia 3 4 2 1 7 5 Dichranoptyche. 3 2* 1 Elliptera. Eriocera. 5 4 6 (1 7) 2 3 Erioptera. 4 3 2 1 — 4 2 1 — 3 4 2 5 1 3 4 (1 6) 5 2* Geranomyia. Helobia. 1 --- 3 6 4 2* 5 1 3 2 6 4 1 5* Holorusia 2 3 1 4 5 Limnobia 5*4316(27) - 324(16)5 - 325*4167Limnophila. Pachvrinia 3 1 -1 3 2 1 5 4 Pedicia 1 2 Ptychoptera. Raphidolabis. 3 2 1 - 3 2 4 1 $3\ 4\ 1\ 5\ 2\ --\ 3\ 6\ 5^*\ (1\ 7)\ (2\ 4)$ Tipula. 2 5* 3 1 6 7 4 Trichocera Trimicra. 2 3 4 5 1

The nomenclature of the veins most used consists in numbering the longitudinal veins from one to six of which the independent is the forth. Schiner names these subcostal, radial, cubital, discoidal, postical and anal veins Comstock calls the first three the radius, the remainder the media, cubital and anal. He interprets the posterior basal crossvein as a branch of the cubital vein.

SYNOPSIS OF FAMILIES.

Bombyliidæ: discal adjacent to last posterior, and each about equal to second basal cell.

Tachinidæ: arista bare and calypteres large.

Asilidæ proboscis horny and face densely bristly below.

Syrphidæ: spurious vein present.

Tipulidæ: thorax with v-shaped suture dorsally.

Empidæ: discal and last two basal cells about equal in length and in distance from hind edge of wing.

Dolichopidæ: discal and second basal cells confluent and first basal cell very short.

Tabanidæ: last fork of primary vein spreading widely.

Culicidæ: veins clothed with scales.

Mycetophilidæ: antennæ longer than thorax. Psychodidæ: body and wings densely hairy. Cecidomyidæ: tibiæ without spurs. Chironomidæ: veins verv feeble on hind half of wing.

Stratiomyidæ: basal cells more than twice as long as discal cell.

Trypatidæ: auxiliary vein absent. Borboridæ: hind metatarsi shorter than other joints and thickened. Ephydridæ and Oscinidæ: discal and second basal cells confluent and third basal absent, the latter consisting of pale colored flies. Agromyzidæ, Geomyzidæ and Drosophilidæ: with oral vibrissæ, the first with hind cross vein before middle of the wing, the last with long plumose or pectinate antennæ.

Threvidæ: five posterior cells. Leptidæ and Cyrtidæ: three pads between the claws, the latter with the head very small.

Muscidæ: calypteres large. Œstridæ: oral opening small. Anthomidæ: first posterior cell wide open. Sarcophagidæ: with outer half of arista bare Dexidæ: base of abdomen bristly.

Ortalidæ: antennæ with dorsal arista. Pipiculidæ: head nearly as large as thorax. Conopidæ: with long slender proboscis. Sepsidæ, Scatophagidæ and Helomyzidæ: with oral vibrissæ, the last with costa pectinate, the second front bristly near antennæ. Micropezidæ: head subspherical. Sapromyzidæ and Sciomyzidæ: first two abdominal segments not at all coalesced, the abdomen of the latter elongate.

Pulicidæ: wingless. Sarcopsyllidæ: labial palpi only one jointed.

Simuliidæ: heavy veins near costa only. Phoridæ: antennæ apparently only one or two jointed.

Blepharoceridæ: wings marked by a net of fine lines.

Midaidæ. Bibionidæ: antennæ many jointed. Apioceridæ and Scenopinidæ: head not hollowed out between the eyes, the latter with only three posterior cells.

The fleas and winged bird lice specialized as parasites on vertebrates are generally separated from other flies tho retained within the order. The more typical flies have generally been classified in one of two ways, by the

structure of the antennæ, or according to the method of escaping from the pupa. These two schemes are now commonly combined making three groups, one with many jointed antennæ, one with a short antenna and the pupa skin splitting normally, and a third group with a circular split.

HIPPOBOSCINA.

HIPPOBOSCIDÆ

This family includes the winged birdlice and also certain tick-like flies. Lipotenia with rudimentary wings, which infests deer, and Melophagus entirely wingless, on sheep. They differ from all other insects by the fact that the whole larval life is passed within the body of the parent. For this reason the family was at one time separated as a distinct order.

Hippobosca ovinus—Melophagus.
Lipotenia depressa (Say.)
Melophagus depressus—Lipotena.

ovinus (Linn.) Olfersia impressa—Stilbometopa. Stilbometopa impressa (Big.)

TRYPETINA.

AGROMIZIDÆ.

The larva of Agromyza simplex is reported as burrowing in asparagus stems and numerous eastern species attack other plants. An eastern Desmometopa has been bred from human excrement while Leucopsis and Coptochætum are parasitic, the latter on the cottony cushion seale.

Agromyza pictella Thom.
platyptera Thom.
simplex Loew.
Coptochætum Iceriæ Wil.

Desmometopa halteralis Coq.
m-nigrum Zett.
Leuccspis nigricornis Big.
Ochthiphila lispina Thom.

DROSOPHILIDÆ.

One species of Drosophila is reported as mining the leaves of cabbages but most of the species live in decaying fruit and vegetables.

Drosophila apicata Thom.

OSCINIDÆ.

The larvæ of all the species of the largest genus Chlorops as far as known feed on the stems of grasses including wheat, and Meromyza is considered a very important pest. Our species of Oscinnus has been reported from wheat but has also been bred from human excrement. Gaurax lives in the egg masses of spiders.

Chlorops assimilis Macq. graminea Coq. proxima Say. rubida Coq. Gaurax araneæ Cog. Hippelates genalis Thom.
Meromyza americana Fitch.
microcentris Coq.
Mcsillus æneus Fall.
Oscinis trigramma Loew.





F'gure 139 Breeding places of Ephydra milbræ

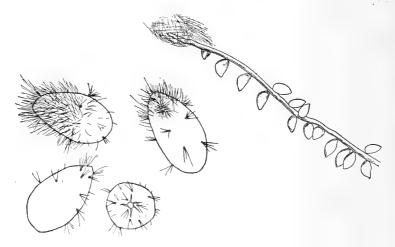


Figure 140 Eggs of Ephydra milbræ.

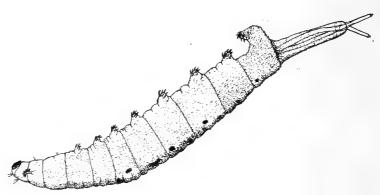


Figure 141 Larva of Ephydra milbræ.

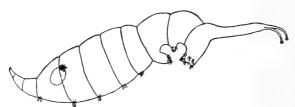


Figure 142 Pupa of Ephydra milbræ.

EPHYDRIDÆ.

Cænia bisetosa Coq. Ephydra californica Pad. cinerea Jones. milbræ Jones. pentastigma-Scatella tarsata Wil.

Hydreliia scapularis Loew. Musca mantis-Ochthera. Notiophila decoris Wil.

quadrisetosa Thom. Ochthera mantis (DeG.) Parydra appendiculata Loew. aurata Jones. Pelina brevis Walk. Pelomyia occidentalis Wil. Psilopa compta Meig. petrolei Ccq. Scatella pentastigma (Thom.) Scatophila hamifera Beck.

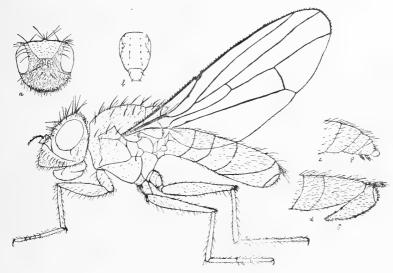


Figure 143 Ephydra milbræ.

SEPSIDÆ.

The cheese maggot P. casei also attacks smoked meats. Species of the other two genera live in excrement.

Musca casei-Piophila. Nemopoda atterima Big.

fulvicoxalis Big. Picphila casei (Linn.)

concolor Thom. obscuripennis Big. Sepsis ecalcarata Thom.

MICROPEZIDÆ.

Calobata lasciva Fabr.

TRYPETIDÆ.

This family contains the fruit flies, highly injurious in other countries, but none of our local species are troublesome.

Acidia fratria Thom. Carphotrichia culta Wied.

cultaris-culta. * Ensina aurifera Thom.







Figure 145 Pupa of Mexican orange m aggot.



Figure 146 Fly of Mexican orange mag got.

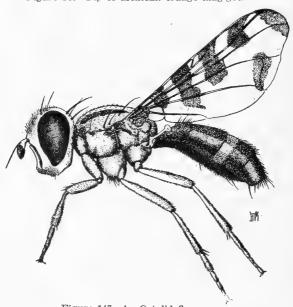


Figure 147 An Ortalid fly.

Euaresta abstersa Loew.

adspersa Coq.
bellula Loew.
californica Coq.
rufipennis Doane.

Eustreta sporosa Wied.
Neospilota signifera Coq.
Zephrina Snow.
Tephritis acutangula Thom.
Straussia longipennis Wieg.

affinis Snow. /

genalis Thom.
rufipennis Doane.
Trypeta achillæ John.
californica Doane.
gemella Coq.
aurifera—Ensina.
culta—Carptotricha.
femoralis—Urellia.
fratria—Alcidia.
longipennis—Straussia.
Urellia femoralis Thom.

naverna Walk.

ORTALIDÆ.

Like the preceeding family many of the species have highly decorated wings.

Acrosticta dichroa Loew.
fulvipes Coq.
Anacampta latiuscula Loew.
pyrrocephalus Loew.
Diacrita æmula Loew.
Epiplatea scutellaris Coq.

Euxesta notata Wied.
Eurycephala myopæformis Roed.
willistonii Coq.
Tetrcpismenus hirtus Loew.
Ulida rubida Loew.

GEOMYZIDÆ.

The larvæ of these flies live in the stems of plants.

Anthomyza variegata Loew.

Zagonia flava Coq.
Baliptera lurida Loew.

SAPROMYZIDÆ.

The larvæ live in decaying vegetable matter.

Lonchæa polita Say.
Luxania albiset a Coq.
nasalis Hhom.
Sapromyza connexa Say.
flaveola Coq.
livingstonia Coq.

lupulina Fabr. notata Fall. planiscutum Thom. quadrisetosum Thom. univittata Coq.

SCIOMYZIDÆ.

Larvæ aquatic.
Sciomyza humilis Loew.
nana Fall.

Tetanocera pictipes Lew. plumosa Loew.

BORBORIDÆ.

Borborus equinus Fall. Limnosia aldrichi Wil. fontimalis Fall.

HELOMYZIDÆ

Anorostoma grandis Dar. maculata Dar. opaca Cq. Leria pectinata Loew. Helomyea limbata Thom. lineata Walk. Siligo litorea Ald.

SCATOPHAGIDÆ.

These flies are very abundant on fresh cow manure upon which the larvæ feed.

Musea etercoraria—Scatophaga. Scatophaga furcata Say. thinobia Thom. stercoria (Linn.) Scatomyza apicata Thom.

MUSCINA.

ANTHOMYIDÆ.

The food habits of the larvæ of this family are quite variable, including the feeding on living plants as leaf miners or root borers.

Anthomyia micropteryx Thom.
ochripes Thom.
orthogaster Thom.
Coenosia argentata Coq.
canescens Stein.
majuscula Coq.
verna (Fabr.)
Fannia æthops Mal.
benjamini Mal.

Hylemyia acanthoe Walk.
variata Fall.
Limnophora cyrtoneura Stein.
Musca verna Cœnosia.
Ophyra leucostoma Wied.
Phaonia varipes Coq.
Schænomyza chrysostoma Loew.
Tetramerinx femorata Mal.

MUSCIDÆ.

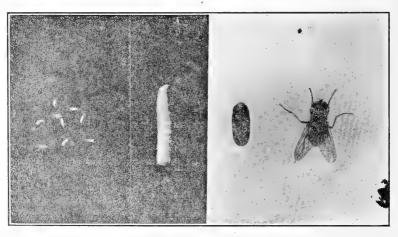


Figure 148 Life history of the house fly.

The house fly, Musca domestica, the stable fly, Stomoxus, the blue bottle flies, Calliphora, the screw-worm fly, Chrysomyia marcelaria and the horn fly, Hæmatobia, are all very common and important insects. The relation of

the house fly in the spreading of typhoid fever has caused special effort to be put forth to prevent their breeding in stable manure. See California Bulletin No. 215.

SYNOPSIS OF GENERA.

Lucilia: proboscis not elongate and row of vertical bristles above hind leg Pollenia and Chrysomyia: vibrissal angles distant from oral margin, the latter bright metalic flies. Phormia: mesonotum flattened behind transverse suture. Calliphora: cheeks hairy.

Musca: proboscis not elongate. Pyrelia and Pseudopyrelia: middle tibiæ with a prominent bristle on the inner surface beyond the middle, the latter with angle of fourth vein rounded. Myiopsila, Morelia and Muscina: last section of fourth vein only broadly curved, the first with eyes pubescent, the last with first posterior cell broadly open.

Stomoxus. Hæmatobia: palpi nearly as long as proboscis.



Figure 149 Effect of quantity of food on size.

Calliphora coloradensis Hough.
vomitoria (Linn.)
Chrysomyia marceliaria Fabr.
wheeleri Hough.
Conops calcitrans—Stomoxys.
Hæmatobia serrata Desv.
Lucillia cæsar (Linn.)
proxima (Walk.)
sericata Meig.
stigmaticollis—Phorma regina.
Musca cæsar—Lucilia.
cornicina—Pseudopyrellia.
domestica Linn.
proxima—Lucilia.

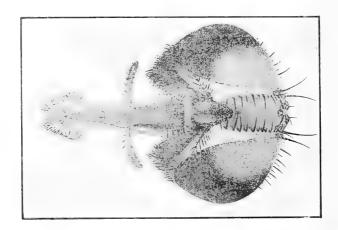
regina—Phormia.
rudis—Pollenia.
vomitoria—Calliphora.
Morellia micans Macq.
Muscina recurva Thom.
Myospila medilabunda Fabr.
Nitellia glabricula—Pollenia.
Phorma regina Meig.
Pollenia glabricula Big.
rudis (Fabr.)
Pyrellia frontalis Thom.
Pseudopyrelia cornicina (Fabr.)
Stomoxys ralcitrans (Linn.)

SARCOPHAGIDÆ.

The members of this family are called flesh flies. The larvæ feed on all kinds of decaying matter.

Sarcophaga davidsonii Coq. orpifera Coq.

palliventris Thom.



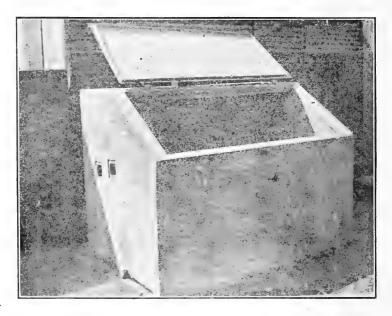


Figure 150. Head and mouth parts of a house fly and concrete manure bin.

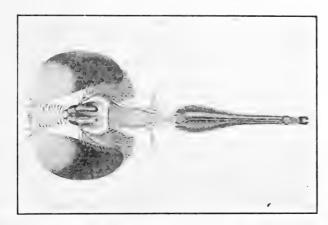




Figure 151. Head and mouth parts of a stable fly and bacteria culture spread by a fly.

DEXIIDÆ.

Melanodexia tristis Walk.

Morphomyia rufinotata. Big.

TACHINIDÆ.

This family and the last are parasitic on other insects.

Acemyia dentata. Coq. tibialis Coq.

Admontia retiniæ Coq.

setigera Coq. Aphria ocypterata Town.

Archytas analis Fabr.

Arthrophoda singularis-Paradidyma.

Belvoisia bifasciata Fabr. Biomyia geogiæ B.&B.

Biepharipeza adusta Loew.

monticola—Chætogædia. Erachycoma davidsoni Coq.

Celatoria crawii-diabroticæ. diabroticæ Shi.

spinosa Coq.

Chætogædia crebra Wulp. monticola (Big.)

Clistogaster divisa Loew.

immaculata Macq. Clausiella setigera Thom.

Cuphocera californiensis Macq. Dejeania rutilioides-Paradejeania.

Demoticus melitææ Coq.

Dexia pedastris-Hypostoma. Drepanoglossa occidentalis-Epigri-

myia. Echinomyia algens Wied.

dakotensis Town.

decisa Walk.

infumata—palpalis Coq.

Epalpus bicolor (Wil.) signiferus (Walk.)

Eumacronychia decens-Hilerella. Euphorocera claripennis Macq.

Epigeimyia occidentalis Coq.

setigera Coq.

Exorista chelionum Rund.

confinis Fal. futilis O.S.

nigripalpus Town.

Frontania aletiæ Ril. ·

armigera Coq.

turgida Coq. frenchi Wil.

Gædiopsis setosa Cog.

Conia capitata. DeG. Graphomyia maculata Scop.

Gymnosoma fuliginosa Desv. Heteropterina nasoni Coq.

Hilarella aristatis Coq.

decens (Town.) siphonina Zett.

Hyalomyia nigrens-Phorantha.

Hypostena ænea Cog.

barbata Coq. pedestris Wal.

tortricis Coq.

vanderwulpi Town.)

Variabilis Coq.

Lasioneura johnsoni Coq. Leskia eucerata Big.

Leucostoma atra Town.

neomexicana Town.

Linnæmyia compta Fal.

Lophosis setigera-Clausicella.

Macquartia pristis Walk. Masicera eufitchiæ Town.

frenchii-Frontina.

pausiseta Coq.

Masistylum macropogon Big Melanophrys flavipennis Wil.

Melanospora diabroticæ-Celatoria.

Metachæta helymus Walk. sequax Wil.

Metaplegia occidentalis Coq.

Microphthalma disjuncta Wied. Micropalpus mizcella-Trichophora.

Miltogramma erythrocaria-Senotania.

sephonia-Hilarella. trilineata-Senotainia.

Musca bifasciata-Belvoisia. planipes-Trichopoda.

radicum-Trichopoda.

Myiophasis robusta Coq. Myocera tibialis Desv.

Myotheria vanderwulpi-Hypostena.

Ochthera mantis DeG.

Ocyptera arcuata-Xanthalmelana.

carotinæ Desv.

Pachyophthalmus floridensis Town. Panzeria radicum Fabr.

Paradejeania rutillioides Jean.

Paradidyma singularis Town. Parexorista cheloniæ-Exorista.

confinis-Exorista.

Peletaria robusta Wied.

Phorocera claripennis-Euphorocera.

erecta Coq.

saundersii Wil. Phorantha nigrens Wulp. occidentalis Walk. Phorichæta sequax Wil. Plagia americana Wulp. Plusia brevirostris Coq. Polidea æros Walk. Prospheripa cerebra-Chætogædia. Pseudochæta argentifrons Coq. Pseudomyothris tortricis-Hypostema. Saundersia bicolor-Epalpus. signifera-Epa.pus. Scopolia sequax-Phorichæta. Senotainia decisa Town. rubriventris Macq. trilineata Wulp. Siphona plusiæ Coq. Siphoplagia anomala Town. Siphoturmia rostrata Coq. Spallanzania antennalis Coq. hesperidarum Wil. Sturmia albifrons Walk. distincta Wied. occidentalis Wil. Tachina albifrons-Sturmia. aletiæ-Frontina. algens-Echinomyia. analis-Archytas analis. californica -Archytas analis. capitata-Gonia. decisa-Echinomyia. disjuncta—Sturmia. distincta—Sturmia.

helumus-Meachæta.

mella Walk.
r busta Town.
robusta—Pelateria.
sigmiferus—Epalpus.
Tachinomyia robusta—Tachina.
Thereva plumipes—Trichopoda.
Trichopoda pennipes Fabr.
plumipes Fabr.

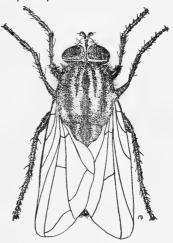


Figure 152 Tachina fly.

Winthemia adusta Loew. antennalis Coq. Xanthomelana arcuata Say.

ŒSTRIDÆ.

The bot flies are parasitic on animals, Œstrus on sheep, Hypoderma on cattle, Gastrophilus on horses and Cuterebra and Bogeria on rodents.

SYNOPSIS OF GENERA.

Cuterebra: mouth parts not rudimentary. Bogeria: arista bare.

Gastrophilus. Œstrus and Hypoderma: first posterior closed or nearly so, the first with the median groove of the face narrowed below.

Bogeria princeps Hust.
Cuterebra latifrons Coq.
leporivora Coq.
nitida Coq.
ternebrosa CCq.
Gastrophilus equi (Clark.)

nasalis (Linn.)
Hypderma lineata Vill.
Œstrus equi—Gastrophilus.
nasalis—Gastrophilus.
ovis Linn.

SYRPHINA

The larvæ of these wasplike flies are parasitic on Hymenoptera.

CONOPIDÆ.

Dalmannia picta Wil.

vitiosa Coq. Myopa conjuncta Thom. pictipennis Wil. pilosa Wil.

Oncomyia abbreviata Loew.

baroni Wil. Ioraria Lew. Physocephala affinis Wil. burgessi Wil. Zodion fulvifrons Say. triste Big.

SYRPHIDÆ.

The syrphus flies feed as larvæ in decaying vegetation and those of the genus Syrphus and its allies feed on plantlice.

Allograpta fracta O.S.

obliqua Say.

Ascemosyrphus mexicanus Macq.

oculierus-mexicanus. baptista—clavata. clavata. Fabr.

lemur O.S. obscuricornis Loew.

Barachopa vacua O.S.

Brachymyia lupina-Criorhina.

nigripes-Criorhina.

chalybescens Wil.

Catabomba pyrastri—Lasiophthicus.

Cerea tridens Loew. Chilosia baroni Wil.

> occidentalis Wil. pacifica Hun. pallipes Loew.

townsendi Hun. willistonii Snow.

Chrysochlamys cræsus O.S.

Chrysogaster bellula Wil. nigrovittata Loew.

stigma Wil. Chrysotoxum derivatum Walk.

villosum-derivatum.

Copestylum marginatum Say. Criorhina coquilletti Wil.

humeralis Wil. lupina Wil. nigripes Wil.

Crioprora alpex O.S. cyanella O.S.

Didea laxa Fabr.

Eristalis æneus Fabr.

hirtus Loew.

latifrons Loew.

stipulator—latifrons.

temporalis Thom. tenax Linn.

Eurhinomamallota lupina-Criorhina. metalica—Criorhina Iupina. nigripes—Criorhina.

Eupseodes volucris O.S. Helophilus latifrons Loew.

mexicanus-Ascemosyrphus. polygrammus-Ascemosyrphus

mexicanus.

similis Macq.

Mesogramma gemmata Say.

marginata Say.

Mesograpta marginata—Mesogramma.

Microdon xanthophilis Town.

Musca pipiens-Syritta. ribesii—Syrphus. tenax—Eristalis.

Myolepta varipes Loew.

Ischgrosyrphus tricolor-Syrphus velutinus.

Lasiophthicus pyrastri Linn.

Mallota sackeni Wil.

Melanostoma bicruciatum Big. pachytarsis Big.

p.ctipes Big. stegnum Say.

Nausigaster punctulata Wil. Orthoneura nigrovitta—Chrysogastersinuosa-Chrysogaster stigmata.

Paragus angustus Loew.

auricaudus-Paragus tibialiss. bicolor Fabr.

pisticodes Wil. tibialis Fall.

Pipiza auricaudatus-Paragus tibialis.

Platychirus albimanus Fabr. ciliatus-albImanus.

quadratus Say.

Pocata alopex—Croiprora. cyanella—Crioprora. bomboides Hun.

Scæva arcuata-Syrphus.

geminata-Mesogramma. marginata.-Mesogramma. obliqua-Allograpia. quadratus-Platychirus.

Sparzigaster bacchoides-Baccha clavata.

Sphærophoria dubia Big. infumata Thom. melanosa Wil. micrura O.S. pyrrhina Big.

sulphuripes Thom. Specomyia brevicornis O.S. Spilomyia interrupta Wil. Syritta pipiens (Linn.)

Syrphus ænaus-Eristalis. albimanus-Platychirus. americanus-Wied.

arcuatus Fall. bicolor-Paragus. clavata-Baccha.

fumipennis Thom. infumata—Sphærophora. intrudens O.S.

lapponicus-arcuatus.

opinator O.S. pigra-Xylota. protritus O.S.

quinquelimbatus Big. ribesii Linn.

sulphuripes-Sphærophora. velutinus Wil.

Triodonta curvipes Wied. Tropidia quadrata Say.

Volucella avida O.S. tan Big.

temnocera Loew.

Xylota analis Wil. barbata Loew.

curvipes Lew. ejuncida Say. flavitibia Big. obscura Loew.



Figure 153 Syrphus fly.

pigra Fabr. esuriens Fabr. marginata-Copestylum. megacephala Loew. mexicana-esuriens.

PIPUNCULIDÆ.

The flies are notable by their large heads. The larvæ are parasitic. Small parasitic flies.

Pipicula bidens Cres.

Pipuncutus aridus Wil.

PHORINA

PHORIDÆ.

The hunchback flies have very diverse food habits.

Aphiochæta minuta Ald. pulicaria Fall. pygmœa Zett.

Phora rufipes Meig. Trineura aterrima (Fabr.) velutina Meig.

ASILINA

LONCHOPTERIDÆ.

Lonchoptera lacustris Meig.

lutea Panz.

EMPIIDÆ.

Chrysotus subcostatus Loew. Clinocera maculipes Big. Drapetis nitidula Mel. unipila Loew. Empimorpha barbata Loew. comantis Coq. geneatis Mel. anca Coq. mira BiBg. nuda Loew. valentis Cog.

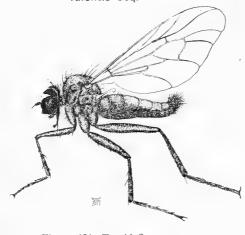


Figure 154 Empid fly.

Enoplempis mira-Empis. Euthyneura atripes Mel. Hilaria cana Coq. congregaria Mel. nugax Mel.

Aphrostylus direptor Whe. grassator Whe. predator Whe.

The larvæ are aquatic feeding on decaying vegetable matter. Hilaromorpha obscura Big. Holocera ravida Cog. Iteaphila peregrina Mel. Leptopeza disparellus Mel. Meghyperus occidens Coq. Microphorus ravidus Coq. Nithicomyia rileyi Coq. tibialis Coq. Platypalpus æqualis Loew. canus Mel. gravidus Mel. Empis ærobatica Mel.

bigoti Mel. cinerea-bigoti. comantis Cog. discoventris-dolobraria. dolobraria Mel. falcata Mel. incultus Cog. incurvis Mel. manco Cog. pluto Mel.

Ramphomyia amplicella Cq. bifilata Coq. californica Cog. curripes Coq. duplicis Coq. fimbriata Coq. loripedis Coq. luctiosa Loew. nigrita Big. scauritissima Whe. scuellaris Coq. stylata Cog. sudigeronis Coq.

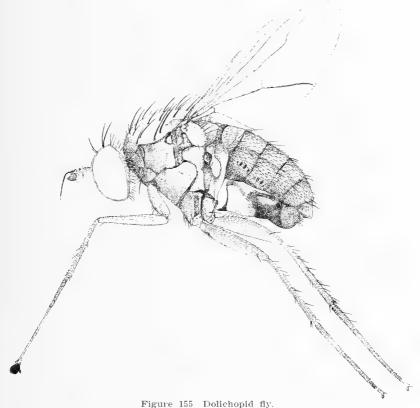
Tachydromia schwartzii Cog. Tachytrechus angustipennis Loew. sanus O.S.

DOLICHOPIDÆ.

Aptorthus nigripes-Mesorhagia. Campsicnemis degener Whe. Dolichopus afflictus O.S.

Hercostomus aurifer Thom. impudicus Whe. metatarsans Thom. Hydrophorus breviseta Thom. eldoradensis Whe. Laincalus querulus O.S.

canaliculatus Thom. consanguineus Whe. corax O.S. crenatus O.S. lamellicornis Thom. metatarsalis-Hercostomus.



paluster Mel. pollex O.S. tenuipes Ald. Marcellocerus sanus-Tachytrechus. Medeterus californiensis Whe. xerophilus Whe. Mesorhaga nigripes Ald. Neurigona lienosa Ald. Nothosymponus vegetus Whe.

Paraclius femoratus Ald. Parasyntormon asellus Whe. emarginatum Whe. largotis Whe. Pelastoneurus cyaneus Whe. dissimilipes Whe. longicauda Loew. occidentalis Whe. Polymedon f'abelilfer O.S.

Psilopodinus pilicornis Ald. Sympycus cuprinus Whe. Synarthrus affine—Syntormon. stratægus-Eyntormon.

Scellus vigil O.S.

Syntormon affine Whe. angustipennis Loew. stratægus Whe. Tachytrechus sanus O.S.

montanus Loew.

ASILIDÆ.

The flies of this family are called robber flies. They feed very ravenously on other insects and the larvæ are also predaceous on other larvæ, being found in rotten wood or under the bark of logs.

Ablantus fulvipes Coq. mimus O.S. trifarius Loew. Andrenostoma fulvicauda-Nusa.

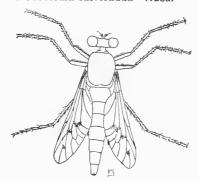


Figure 156 Asilid fly.

Anisopogon ludius-Heteropogon. senilis-Heteropogon. vespoides-Heteropogon. Asilus abdominalis-Osprioceous. Blacodes clausa-Cophura. cristatus-Cophura. trunca-Cophura. Chrysoceria pictitarsus (Big.) Clavator sabulonum-Lestomyia. Cophura clausa (Coq.) cristata (Coq.) fallei Back. truncata (Coq.) Cyrtopogon aurifer O.S. callipedilus Loew. cerusattus O.S. cretaceus O.S. cymbalistata O.S. evidens O.S. gibber Big. leucozonus Loe ...

longimanis Loew.

nebulo O.S. nigricolor coq. nugator O.S. positivus O.S. princeps O.S. rattus O.S. rejectus O.S. sudator O.S. Dasyllis astur O.S. Dasypogon argenteus-Stictopogon. californiæ-Stictopogon. quadrinotatus Big. trifasciatus-Stictopogon. Deromyia pulchra Bac. Dicolonus simplex Loew. Dioctria albina Walk. parvula Cog. pusio O.S. resplendens Loew. rubida Coq. vera Back. Erax cinerascens Bel. furax-cinerascens. Habropogon bilineatus Wil. ludens (Coq.) senilis-Pycnopogon. vespoides Big. Heteropogon Iudius (Coq.) senilis (Big.) vespoides (Big.) Holopogon appendiculatus—Cyrtopogon gibber. nitidiventris Big. umbrinus Back.

Lampria felis O.S.

Laparus pictitarsus—Chrysoccia.

anthrax-carbonarius. franciscanus Big.

fulvicauda-Nusa.

Laphria carbonarius Wil.

rapax O.S.

ventralis Wil.

Lasiopogon arenicola O.S. bivittatus Loew. Leptogaster scapularis big. Lestomyia fraudigera Wi.. sabulonum (O.S.) Mallophora megachile Cog. Metapogon gilvipes Coq. Myelaphus iobicornis (O.S.) melas Big. rufus Wil. Neclaparus pictitarsus Big. Nicocles abdominalis Wii. æmulaor (Loew.) argentatus Cog. dives (Loew.) Nusa fulvicauda Say. Ospriocerus abdominalis (Say). Pycnopogon cirr.atus O.S. senilis-Heteropogon. rygostalus æmulator-Nicocles.

dives-Nicocles Sarapogon hyalinus Coq. luteus Coq. semiustus Coq. Scleropogon jubatus-Stenopogon. picticornis-Stenopogon. Stenopogon albibasis Big. breviusculus Loew. californiæ (Walk.) gratus Loew. jubatus Loew. nigritulus Cog. obscuriventris-californiæ. picticornis Low. univittatus-gratus. Stictopogon argentatus Say. trifasciatus (Say), Triclis tagax Wil. Willistonia bilineatus Back.

SCENOPIDÆ.

rseudatrichia griseola Coq.

THEREVIDÆ.

Metaphragma planiceps Loew.
Nebritis pellucidus Coq.
Psilocephala aldrichii Coq.
baccata Coq.
costalis Loew.
marcida Coq.
montivaga Coq.
pavida Coq.
Thereva cornata Loew.

crassicornis Wil.
egressa Coq.
furcata Loew.
melaneura Loew.
nigra Say.
otiosa Coq.
semitaria Coq.
vialis O.S.

Xestomyza planiceps-Metaphragma.

BOMBYLINA

APIOCERIDÆ.

Apiocera haruspex O.S. Apomydas trochilus Coq.

Raphiomydas acton Coq.

MYDAIDÆ.

The larvæ live in decaying wood and are predaceous.



Figure 157 Venation of a Mydiad

Leptomydas concinnus Coq.
hirtus Coq.
pantherinus Gar.
tennuipes (Loew.)
Mydas tennuipes—Leptomydas.
ventralis Ger.

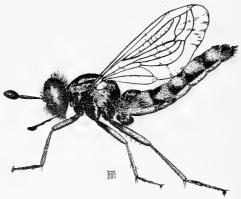


Figure 158 Mydiad fly

BOMBYLIIDÆ.

The flies of this family are particularly abundant in species in this state tho the individuals are not excessively numerous. The larvæ are parasitic, some on the eggs of grasshoppers, many on bees and wasps.

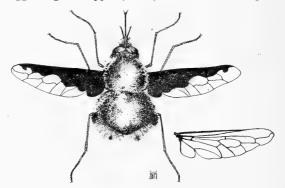


Figure 159 Bombyliid fly

Agyramoiba cybele—Spongostylum.
delila Spongostylum.
limatulus—Spongostylum
varia—Spongostylum.
Amphicosmus elegans Coq.
Anastocchus barbatus—nitidulus.
nitidulus Fabr.
Anthrax adumbrata Coq.
ænea Coq.
agrestis—Lepidanthrax.
agrippina O.S.

alpha O.S.
alternata Say.
anna Coq.
atrata Coq.
bigradata Loew.
campestris—Lepidanthrax.
caprea Coq.
catulina Coq.
cautor Coq.
cinefacta Coq.
consessor Coq.

vana Cog.

procina Cog. cumenes O.S. curta Coq. diagonalis Loew. edelia-perplexa. edwardsii Coq. endora Cog. eumenes O.S. fenestratoides Coq. fuliginosa Loew. fulvicoma Coq. fumida Coq. gemella Coq. hircina Coq. inaurata-Lepidanthrax. inculta Coq. inops Coq. junctura Coq. junctura-Dipalta. lacunaris Coq. lanta-Lepidanthrax. lepidota O.S. levicula Coq. limatulus-Spongostylum. lucifer Fabr. mercedis Coa. mira Cq. miscella Coq. mobile Coq. molitor Loew. mucorea-muscaria. muscaria Coq. nebulosa Coq. nugator Coq. obscura Coq. ædipus-Spongostylum. pallidula Coq. perimele—alternata. perplexa Coq. pœcilogaster O.S. pretiosa Coq. pullata Coq. sabulosa Coq. scitula Coq. serpantura Coq. serpentina-Dipalta. sinuosa Wied. squamigera Coq. supina Coq. syrtis Coq. systis Coq. tantilla Coq. telluris Coq. terrena Coq. turbata Coq.

variata Coq. varium-Spongostylum. vasta Coq. vigilans—perplexa. vulpina Coq. willistonii Coq. Aphœbantus abnormis Coy. brevistylus Coq. capax Coq. catulus Cog. cervinus Loew. concinnus (Coq.) desertus Coq. fucatus Coq. fumidus Cog. fumosus (Coq. hirsutus Coq. interruptus Coq. leviculus Coq. litus Coq. marcidus Coq. m xtus Cog. mus O.S. pavidus Cog. pellucidus (Coq.) scriptus Coq. tardus Coq. transitus Coq. varius Coq. vittatus Cog. vulpecula Coq. Bibio capicina-Exoprosopa. lucifer-Anthrax. Bombilius albicapillus Loew. aurifer O.S. cachinnans O.S. cinerius Big. fratellus-major. lancifer O.S. laticeps BBig. major Linn. metopium O.S. nitidulus-Anastœchus. recurvus Coq. syndesmosus Coq. Coquillettia vandykei Coq. Dipalta junctura Coq serpentina O.S. Eclimus californicus Big. melanosus Wil. puella Wil. lotus Wil. marginatus O.S. muricatus O.S.

Epacmus nebritus Coq. rufilimbatus Big. Eucessia rubens Coq. Exepacmus johnsoni Coq. Exoprosopa agasizii Lew. capicina Fabr. bifurca Lew. divisa Coq. dorcadion-capacina Fabr. eremita O.S. gaurophylax-Hyperalonia. grata Coq. pallens Big. Exoptata divisa-Exoprosopa. Germinaria pellucida Coq. Geron cinctura Coq. fasciola Coq. hybus Coq. senilis Fabr. trochilus Coq. Hyperalonia gazophylax Loew. lanta Coq. Lordotus apicula Coq. buceros Coq. canabis Cog. Lepidanthrax agrestis Coq. angulus O.S. campestris Cq. inaurata Coq. diversus Coq. junceus Coa. miscellus Coq. planus O.S. sororcula Wil zona Coq.

Mancia nana Coq. Metacosmus exilis Coq. Pantarbes capita O.S. Paracosmus edwardsii (Loew). insolens Coq. Phthiria diversa Coq. egerminans Loew. humilis O.S. notata Loew. similis Coq. sulphurea Loew. Pleas amabilis O.S. atratula Loew. fenestrata O.S. johnsoni Coq. melanocerata Big. nigripennis Loew. obesula Loew. rufula O.S. serrata. Coq. Rhambdoselaphus mus Big. Spogostylum cybele Coq. daphne (O.S.) delila Loew. limatulus Say. œdipus Fabr. vandykei-Coquillettia.. varium Fabr. Systochus oreas O.S. Thalipsogaster syndesmosus-Bombyl-Triplasius novus Wil. Toxophora maxima Coq. pellucida Coq. vasta Cog.

TABANINA

CYRTIDÆ.

Eulonchus marginatus O.S. sapphirinus O.S. saragdinus Gers. tristis Loew.

Oncodes melampus Loew.
Opsebius pancus O.S.
sulphuripes Loew.
Pterodontia vix Town.

LEPTIDÆ.

Atherix varicornis Loew.
Chrysopila anthracina Big.
humilis Loew.
Dialysis dispar BiBg.
Hilaromorpha obscura Big.
Leptis costata Loew.
incisa Loew.
Leptotricha discolor—Triptotricha.

lauta—Triptotricha.
Mythicomyia rileyi Coq.
tibialis Coq.
Rhachicerus honestus O.S.
Symphoromyia cruenta Coq.
modesta Coq.
pachyceras Wil.
trucis Coq.

Triptotricha discolor Loew.
dispar—Dialysis.
lauta Loew.

Xylomyia pallipes Loew. subula—pallipes.

TABANIDÆ.

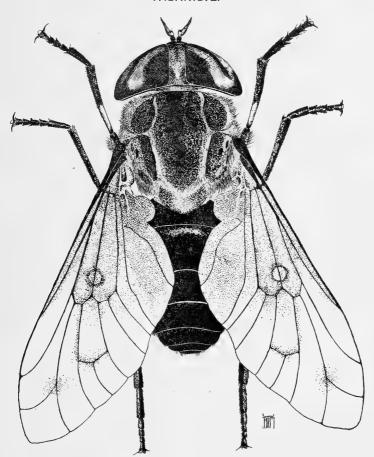


Figure 160 Tabanid fly

The horseflies are not very abundant in California but in other sections are very annoying to stock. The larvæ are predaceous and found in all sorts of situations.

Apatolestes comastes Wil. Chrysops fnlvaster O.S. gigantulus—Silvius. noctifer O.S. pachycera Wil. proclivis O.S.



Figure 161 Head and mouthparts of a Tabanid

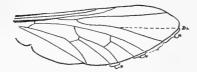


Figure 162 Venation of Tabanidæ and related groups

quadrivitatus—silvius.
surdus O.S.
Corizoneura ruficornis—Pangonia.
velutina—Pangonia.
Diatominerva californica—Pangonia.
Hæmatopate americana O.S.
Pangonia californica (Big.)

gonia californica (Big.)
dives Wil.
hera O.S.
ruficornis (Big.)

velutina (Big.) Silvius gigantulus (Loew.) quadrivitatus Say.

Tabanus ægrotus O.S.
captouis Mar.
comastes Wil.
episatus O.S.
insuitus O.S.
laticeps Hine.
lineola Fabr.
phanerops O.S.
procyon O.S.
punctifer O.S.
rhombicus O.S.
sonomensis O.S.

Aochletus obscurus Coq.
Chloromyia viridis—Sargus.
Clitellaria lata Loew.

STRATIOMYIDÆ.

The larvæ are carnivorous and found in various situations.



Figure 163 A Stratiomyid fly.

villosulus Big.
Thermoplectus californicus—Tabanus
epistatus.
captonis—Tabanus.
rustica O.S.

phænops-Tabanus. procyon—Tabanus. sonomensis-Tabanus. Euparyphus apicalis Coq. niger Big. septemmaculatus Adams. tahoensis Coq. Nemotelus arator Mel. tristus Big. Odontomyia americana Day. arcuata Loew. binotata-truquii. cincta Oliv. hodiana Big. inequatus Loew. megacephala-truquii. pilosus Day. pubescens Day. pyrrhostoma-qilosa. truquii Bel.

hæmaphorus-Tabanus sonomen-

Oxcera crotchi O.S. Sargus viridus Say. Stratiomyia barbata Loew.

nevadæ Big. maculosis Loew. melanosoma Loew.

BIBIONINA

BLEPHAROCERIDÆ.

The larvæ live in mountain streams.

Bibiocephala comstocki Kel. doanei Kel.

Blepharocera ancilla—Philorus.

jordani Kel. ostensakeni Kel. yosemite—Philorus.
Liponeura yosemite—Philorus.
Philorus ancilla O.S.
yosemite O.S.

SIMULIIDÆ.

Buffalo gnats or black flies sometimes become exceedingly annoying on account of their blood sucking habits. The larvæ are aquatic.

Simulium argus Wil.

bracteatum Coq. pictipes Hag. hirtipes Frles. venustum Say. vittatum Zet.



Figure 164 Venation of Simulidæ and related families.

BIBIONIDÆ.

The larvæ feed on decaying vegetable substances.

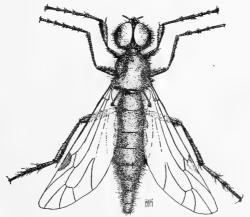


Figure 165 Bibionid fiy.

Bibio hirtus Loew. nervosus Loew. Dilophus occipitalis Coq. Scatopse notata (Linn). Tipula notata—Scatopse.

TIPULINA

CECIDOMYIDÆ.

One species, the hessian fly, Myetiola, is a very serions pest on wheat, but not particularly so in this state. Other species feed as larvæ on decaying vegetable matter, and one of our species, Arthrochodax, feeds on red spiders.



Figure 167 Larva of a Mycetophilid.

Arthrocordax epiphila Felt.
occidentalis Felt.
Cecidomyia destructor—Myetiola.
radiatæ S.&M.

Diplosis piniradiatæ—Cecidomyia.
Myetiola destructor (Say).

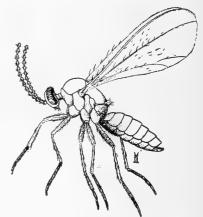


Figure 168 Mycetophilid fly.

MYCETOPHILIDÆ.

The larvæ feed on decaying vegetable substances.

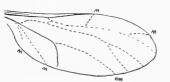


Figure 166 Venation of Mycetophilidæ and related families.

Acnemia varipennis Coq. Alodia bella Joh. delita Joh. Cœlosia flavicauda Win. gracilis Joh. lepida Joh.
modesta Joh.
pygophora Coq.
Cordyla neglecta Joh.
Dacosia obscura Coq.
Gnorista megorrhina O.S.
Leia lineola (Adams).
striata (Wil.)
Mycomyia calcarata (Coq.)
frequens—littoralis.
littoralis Say.
mendax Joh.
Bolitophila hybrida Meig.
Mycetophila ienistrata Coq.
nemoralis—Neuratelia.

obscura-Dacosia.

trifasciata Coq.
Neoglaphyroptera lineola—Leia.
striata—Leia.
Neoempheria pullata—Platyura Coq.
Neuratelia nemoralis (Meig.)
silvatica Coq.

Platura pullata (Coq.)
scapularis Joh.
Rhymosia a Joh.
diffissa Joh.
imitator Joh.
Sciophila calcarata—Mycomyia.

CULICIDÆ.

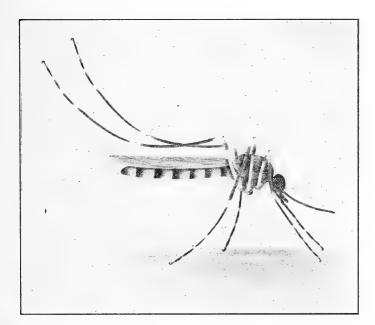


Figure 170 Culiseta.

Mosquitoes are insects of peculiar interest on account of the relation between Anopheles and malaria and Ædes calopus and yellow fever. The latter insect occurs only rarely in a few sea ports in California and the disease is unknown here. Malaria however is wide spread in the central and northern sections coincident with the distribution of the Anopheles. In the San Francisco bay region two species of salt marsh mosquitoes, Ædes quaylei and squamiger are at times very annoying. Very successful control measures have been employed. (See California Bulletin Number 178). The two most common fresh water mosquitoes in the same region are Culex tarsalis and Culiseta incidens.

Æles æstivalis Dyer. calopus (Meig.) curiei (Coq.) damnosa Say.

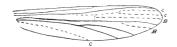


Figure 169 Venation of Culicidæ and related families.

punctipennis Say.
Corethra Trivitata Loew.
Culex annulatus—Theobaldia.
ciliata—Psorophora.
cubensis Big.
currei—Aedes.

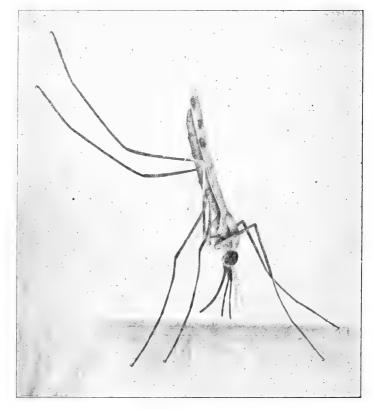


Figure 171 Anopheles.

quaylei D.& K.
spenceri (Theo.)
squamiger (Coq.
sylvestris (Theo.)
varipalpus Coq.
vittatus Theo.
Anopheles franciscanus McC.
maculipennis Mieg.

erythrothorax Dyer.
incidens—Culiseta.
inornatus—Culiseta.
pipiens Linn.
pulchripennis—Anopheles.
spenceri—Aedes.
squamiger—Aedes.
stigmatosoma Dyer.

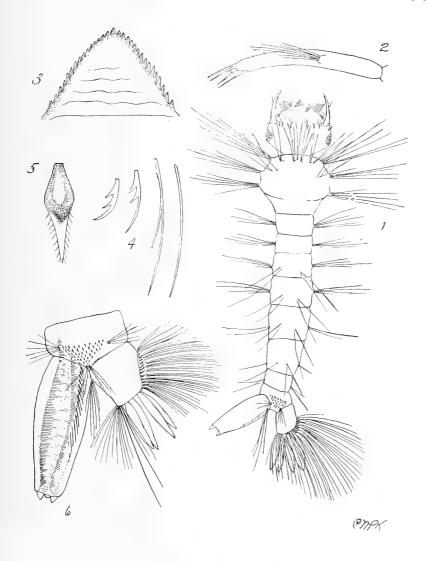


Figure 172 Culiseta incidens. 1,larva; 2, antennæ; 3, mentum; 4, siphonal spines showing variation; 5, scale of eighth abdominal segment; 6, eighth and ninth abdominal segments and siphon; all enlarged.

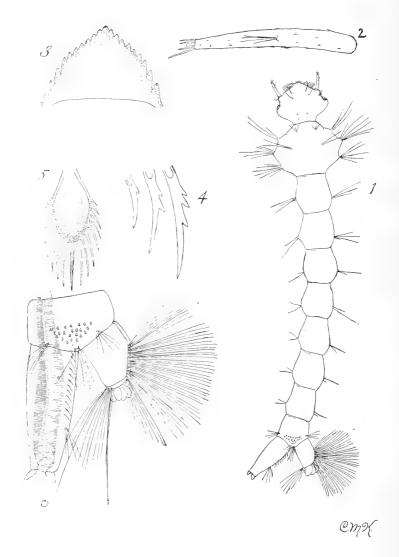


Figure 173 Ædes squamiger. Same parts as in figure 172

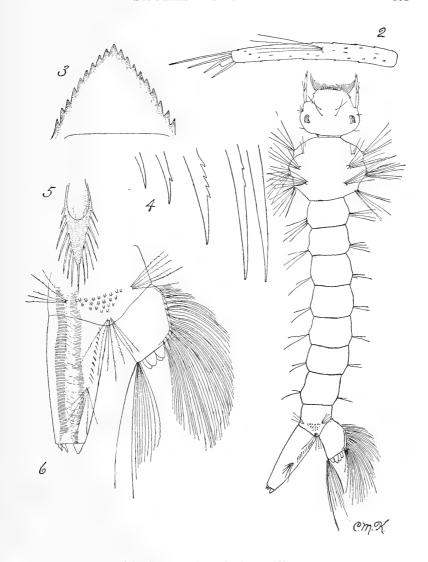


Figure 174 Ædes quaylei. Same parts as in figure 172.

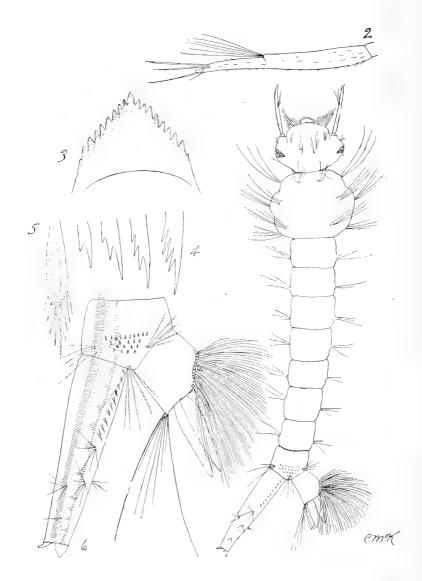
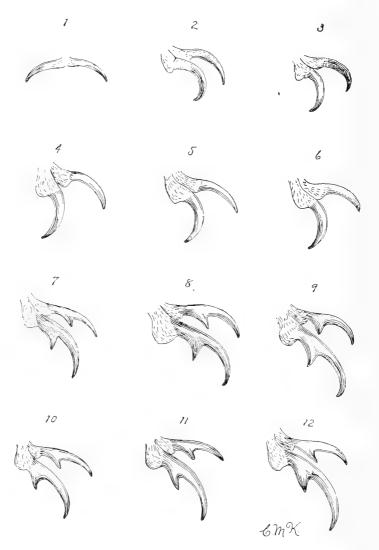


Figure 175 Culex tarsalis. Same parts as in figure 172.



Figure 176 Wings of female mosquitoes. 1, Culiseta incidens; 2, Culex tarsalis; 3, Ædes squamiger; 4, Ædes quaylei.



rigure 177 Claws of Mosquitoes. 1 - 3 Culex tarsalis; 4 - 6 Culiseta incidens; 7 - 9 Ædes squamiger; 10 - 12 Ædes quaylei.

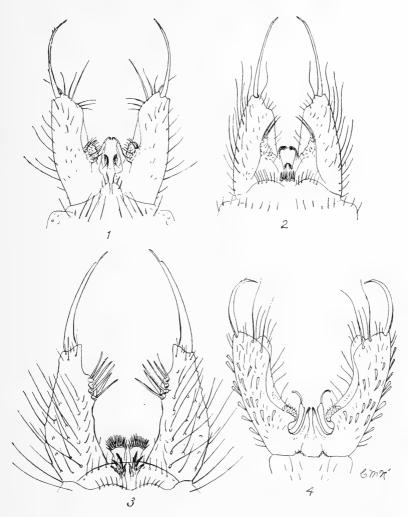


Figure 178 Genitalia. 1, Ædes quaylei; 2, Culiseta incidens; 3. Culex tarsalis; 4, Ædes squamiger.

sylvestris—Aedes.
tarsalis Coq.
territans Walk.
Culiseta consobrina—inornata.
incidens (Thom.)
inornata (Wil.)

maccrackenæ D.&H.
Grabhamia currei—Aedes.
demiedmanii Lnd.
Leptoplatys squamiger—Aedes.
sylvestris—Aedes.
Mansonia signifer Coq.

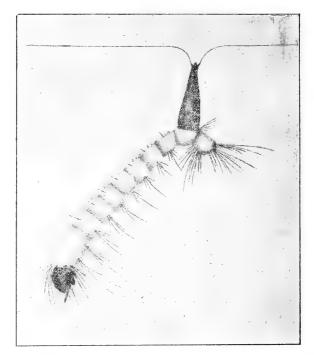


Figure 179 Culiseta larva.

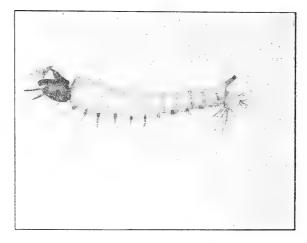


Figure 180 Anopheles larva.

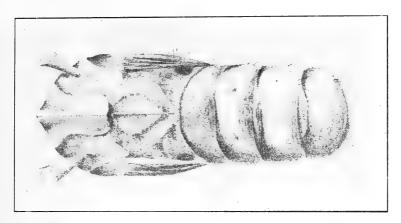


Figure 181 Culiseta. Back view.

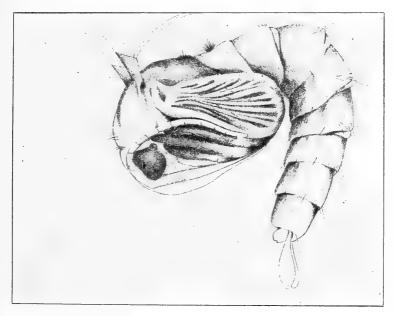


Figure 182 Culiseta. Side view.

varipalpus—Aedes. Ochlerotatus lativittatus—Aedes Curriei.

sylvestris—Aedes. varipalpus—Aedes. Psophora ciliata (Fabr.) Stegomyia calopus—Ædes.
Theobaldia annulatus Schrank.
incidens—Culiseta.

Tæniorhynchus sierrensis—Aedes varipalpus. Uranotœnia anhydor Dyer.

TENDIPEDIDÆ.

Larvæ. aquatic.

Eretmoptera browni Kel.

Paraclunio trilobatus Kief.

PSYCHODIDÆ.

The larvæ feed on decaying vegetable substances.

Pericoma bipuncta Kin.
californica Kin.
californiensis—californica.
truncata Kin.
Psychoda cinerea Banks.
pacifica—cinerea.
Seorax lanceolata—Trichomyia.
Trichomyia lanceolata (Kin.)



Figure 183 Venation of Psychodidæ.

TIPULIDÆ.

The larvæ of the long legged crane flies called leather jackets are sometimes abundant enough to do serious injury to the roots of plants.

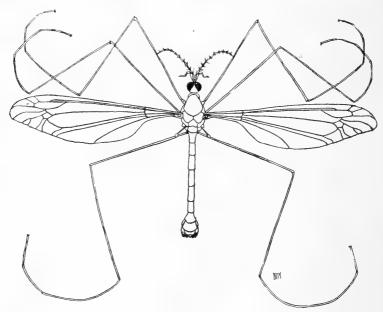


Figure 184 Tupilid fly.

A malopsis calcar O.S.
Bittacomorpha clavipes Fabr.
Ctenophora angustipennis Low.
Dicranomyia badia (Walk.)
marmorata O.S.
stigmata Doane.

obscura O.S. Dicranoptycha sobrina O.S. Elliptera clausa O.S.

Eriocera californica O.S.
obscura Wil.
Eriontera bipartita O.S.

Erioptera bipartita O.S. dulcis O.S. Geranomyia canadensis (Westw.)

Helobia punctipennis Meig.
Holorusia rubiginosa Loew.
Idioplasta vipio O.S.
Limnobia badia—Dicanomyia.
califrnica O.S.

punctipennis—Helobia. sciophila O.S. Limnibiorhynchus canadensis—Geron-

omyia.

Limnophila damnula O.S. luteipennis O.S. montana O.S.

Mololophilus forciplua O.S. Pachyrhina derruginea Fabr. Pachyrina ferruginea (Fabr. Wulpiana Berg.

Pedicia obtusa O.S. Phylolabis claviger O.S. encausta O.S. Protoplasta vipio—Idioplasta.
Ptychoptera lenis O.S.
Raphidolabis debilis Wil.
Symplecta punctipennis—Helobia.
Tipula acuta Doane.

betula O.S.
bituberculata Doane.
clavipes—Bittacomorpha.
fallax Loew.
ferruginea—Pachyrhina.
graphica Doane.
precisa Loew.
pubera Loew.
simplex Doane.

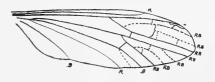


Figure 185 Venation of Tupilidæ.

spermax O.S.
subtilis Doane.
tristis Doane.
Trichocera trichoptera O.S.
Trimicra anomala O.S.
pallipes—Anomala.

PULECINA

PULECIDÆ.

The fleas have come to very great prominence since the relation of L. cheopus to bubonic plague has been demonstrated. Most of the species are found only on rodents, but C.canis and P. irritans are important household pests.

Anomiopsyllus californicus Bak. Ceratopyllus acutus Bak.

anisus Roth.
californicus Bak.
ciliatus Bak.
fasciatus Bosc.
ignotus Bak.
londiniensis Roth.
multidentatus Fox.
niger Fox.

proximus Bak.
sexdentatus Bak.
telchium Roth.
Corypsylla ornatus Fox.
Ctenocephalus canis Curt.
felis Roth.
Ctenophthalmus heiseri McC.
Ctenopsyllus musculi Duges.
Hoplopsyllus anomalus Bak.
Lœmopsylla cheopsis Roth.

Odontopsyllus charlottensis Bak. wymani Fox. Pulex cheopsis—Læmopsyllus. irritans Linn.
pallidus—Lœopsylla cheopsis.

SARCOPSYLLIDÆ.

The chicken flea is occasionally abundant and annoying. Echidnophaga gallinacea Westw.

COLEOPTERA.

Numerically the Coleoptera is far in the lead of all other groups. Half the species of insects are beetles. The order contains about 40 per cent. of all the species of animals and approximately a quarter of all living beings both plants and animals.

Historically the group stands intermediate between the older orders of insects and the higher groups. Beetles are the culmination of the tendency seen in the Orthoptera and Hemiptera to produce a fully armored insect, a consummation reached only after the securing of complex metamorphosis which was also the antecedent condition permitting the specializations of structure characterizing the Diptera, Hymenopteha and Lepidoptera.

Structurally the Coleoptera are distinguishable by the concurrent specialization of front wings and abdomen whereby the ventral portion of the latter became enlarged joining with the former, enclosing a cavity into which the spiracles open and within which the second pair of wings lie folded. Both of these structures are absolutely distinctive of this order.

Economically beetles fall into a very secondary rank. While many are plant feeders, the great majority feed on decaying organic matter or are predaceous.

The classification of beetles was formerly largely based upon the number of joints in the foot, more recently the significance of the venation has been recognized.

The system adopted in this book is the use of a series of superfamilies as follows:— $\,$

- 1. Carabina, 2. Tenebrionina, 3. Meloina, 4. Elaterina, 5. Cantharina, 6. Clerina, 7. Hydrophylina, 8. Scarabæina, 9. Curculionina, 10. Chrysomelina, 11. Coccinellina, 12. Nitidulina, 13. Dermestina, 14. Heterocerina, 15. Histerina, 16. Trichopterygina, 17. Silphina, 18 Staphylinina.
 - The classification of Leconte and Horn, which has been generally followed

in this country is given below with the numbers of the superfamilies.

Coleoptera. (genuina).

Isomera.

Adephaga. — 1.

Clavicornia. — 7, 11, 12, 13, 14, 15, 16, 17 and 18.

Serricornia. - 4, 5 and 6.

Lamellicornia. — 8.

Phytophaga. — 10.

Heteromera. - 2 and 3.

Rhynchophora. - 9.

The latest German system, that of Reiter is as follows:-

Adephaga. - 1.

Polyphaga.

Staphylinoidea.

Staphylinida. — 18

Necrophaga. - 17.

Ptiliigia. - 16.

Histerida. — 15.

Lamellicornia. - 8.

Palpicornia. — 7.

Diversicornia.

Hygrophili. - 14.

Clavicornia. — 11 and 12.

Brachymera. — 13.

Sternoxia. - 4.

Malacodermata. — 5.

Teredilia. - 6.

Heteromera. - 2 and 3.

Phytophaga. — 10.

Rhynchophora. — 9.

SYNOPSIS OF FAMILIES.

Staphylinidæ: abdomen exposed and horny above. Clavigeridæ: antennæ less than six-jointed. Pselaphidæ: abdomen inflexible.

Carabidæ: hind legs with large egg-shaped trochanter, and legs not fitted for swimming. Cicindelidæ: antennæ on the front. Amphizoidæ: metasternum truncate behind. Haliplidæ: hind coxæ covering base of legs.

Tenebrionidæ: hind feet four-jointed, others five-jointed, antennæ not clubbed, front coxal cavities closed behind. Alleculidæ: claws pectinate. Ægialitidæ: six ventral segments.

Curculionidæ: feet four-jointed, antennæ clubbed and either head with a distinct beak, or gular sutures wholly confluent or obliterated. Ipidæ: elytra surrounding edge of pygidium. Otiorhynchidæ: with scar at tip of mandible. Calandridæ: with pygidium undivided in the male. Rhynchitidæ, Rhinomacer-

idæ and Anthribidæ: with antennæ straight and ventral segments free, the first without labrum and the second with prosternal sutures distinct.

Chryscmelidæ: feet apparently four-jointed, the fourth joint very minute

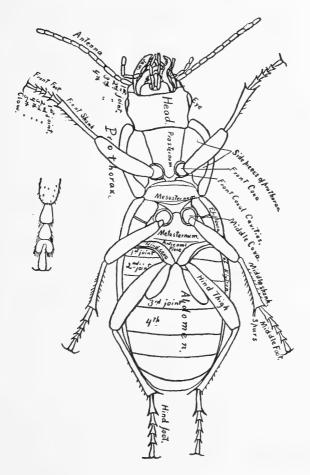


Figure 186 Structure of a beetle.

antennæ not distinctly clavate, shorter than legs. Lariidæ: front long almost snout-like.

Cerambycidæ: similar to Chrysomelidæ but with long antennæ. (in doubtful cases the subcylindrical shape of body will aid in distinguishing this fam-

ily from the preceeding). Spondylidæ: feet slender.

Malachiidæ: body with extensile vesicles.

Elateridæ: prothorax with spine fitting deep into a cavity on mesosternum. anterior coxæ round and ventral segments free. Throscidæ: front coxal cavities open behind. Cerophytidæ: hind coxæ not entirely covering femora. Eucnemidæ: labrum concealed.

Coccinellidæ: feet three-jointed. Sphæriidæ: only three ventral segments. Mydroscaphidæ: antennæ eight-jointed. Monotomidæ: last ventral segment long. Trichopterygidæ: elytra truncate. Endomychidæ, Ptiliidæ and Lathrididæ: claws slender, the last two with feet slender, the last one with hind coxæ widely separated.

Scarabæidæ: antennæ lamellate. Lucanidæ: plates of antennæ immovable. Buprestidæ: similar to Elateridæ, but first two ventral segments connate.

Anthicidæ: hind feet four-jointed, others five-jointed, antennæ not clubbed. hind coxæ prominent. Monomidæ: antennæ in grooves. Œdemeridæ, Melandridæ and Pythidæ: head not strongly constricted behind, the first with middle coxæ prominent, the last with thorax not margined. Mordellidæ and Rhipiphoridæ: thorax as wide as elytra, the latter with the lateral sutures of prothorax wanting.

Histeridæ: antennæ elbowed.

Anobiidæ: head retractile, tarsi five-jointed, abdominal segments five and front and middle coxæ round hind coxæ transverse. Ptinidæ: antennæ inserted on the front. Lyctidæ: first ventral segment elongate. Psoidæ: head prominent. Bostrichidæ: tibiar spurs distinct.

Hydrophilidæ: legs paddle-shaped, antennæ clubbed.

Dytiscidæ: legs paddle-shaped. Grynidæ: front legs largest.

Meloidæ: hind feet four-jointed, others five-jointed, antennæ not clubbed. Cephaloidæ: head elongate tapering behind. Pyrochroidæ: claws simple.

Cantharidæ: front coxæ round, abdomen with seven to nine segments. Stylopidæ: antennæ: not over six-jointed.

Silphidæ: hind coxæ prominent. Melyridæ: metasternum short. Scydmænidæ: eyes coarsely granular. Clambidæ: hind coxæ lamellate. Anisitomidæ: front coxal cavities closed behind

Nitidulidæ: front coxæ transverse. Georyssidæ: antennæ nine-jointed. Heterochroidæ: four abdominal segments connate. Derodontidæ, Byrridæ, Nosodendridæ, Dryopidæ and Cupesidæ: hind coxæ hollowed out to receive femora, the first with metasternum long, the second and third with it short, the third having prominent head, the fourth with fifth joint of tarsi as long as other joints combined. Sphindidæ: metasternum long. Ostomidæ: metasternum emarginate behind. Dascyllidæ: with hind coxæ contiguous. Helodidæ: front coxa without trochantin.

Dermestidæ: metasternum small. Byturidæ: second and third tarsal joints lobed beneath.

Cleridæ: feet with membramous appendage beneath.

Cucujidæ: abdominal segments free. Othniidæ: front coxal cavities closed. Scaphidiidæ: with fifth abdominal segment longest. Phalacridæ: middle coxæ transverse. Lymexylidæ: head deflexed. Corylophidæ: six abdominal segments. Monotomidæ, Endomychidæ, Cryptophagidæ and Ciidæ: first abing tarsi four-jointed with third joint very small, the last has all tarsi four-dominal segment longest, the first two with eyes transverse, the second hav-jointed. Erotylidæ and Mycetophagidæ: hind coxæ not nearly contiguous, the latter with anterior coxæ oval.

Colydiidæ. Rhyssodidæ: feet five jointed.

CARABINA

CICINDELIDÆ.

The tiger beetles are very active day flying, predaceous insects.

SYNOPSIS OF GENERA.

Cicindela. Omus: eyes small. Tetracha: third joint of maxillary palpi longer than fourth.

Amblychile cylindriformis (not Calif)
piccolominii (not Calif.)
Cicindela californica—circumpicta.

cinctipennis Lec. circumpicta Laf.

decemnotata (not Calif.)

depressula Casey.

duodecimguttata (not Calif.)

eureka Fall. fulgida Say.

gabii Horn

graminea—purpurea. gravidus—hirticollis.

guttifera—oregona.

hyperborea Lec. (not Calif.)

hæmorrhagia Lec. hirticollis Say.

imperfecta—pusilla.

latesignata Lec. lauta—purpurea.

lemniscata Lec.

longilabris Say. lunilonga Schaupp.

obliqua—vulgaris.

obsoleta Say. oregona Lec.

pacifica—hæmorhagica. perviridis—longilabris.

plutonica—purpurea. prætexta—circumpicta.

prætexta-circumpict pseudosenilis-echo.

purpurea Oliv.

pusilla Say.

repanda Dej. senilis Horn.

sierra-vulgaris.

sigmoidea—tortuosa.

sommeri Mann.

sperata Lec. tenuisignata. Lec.

terricola—pusilla.

trifasciata—tortuosa. rifasciata—tortuosa.

tuolumne-lunalonga.

vibex—vulgaris.

viridisticta Bates.
viridissima—vuigaris Say.

vulgaris Say.

Omus ambiguus Schaupp. audouini Reiche.

californicus Esch.

confluens—sequoarum.

dejeani (not Calif.)

edwardsii Crotch.

elongatus—californicus. hornii—sequorarum.

lævis Horn.

lecontei-californicus.

lugubris-edwardsii.

montanus-edwardsii.

punctifrons—sequorarum. sculptilis—californicus.

sequorarum Crotch.

submetallicus Horn.

Tetracha carolina Linn.

CARABIDÆ.

The Carabidæ are ground beetles, predaceous both as larvæ and adults.

SYNOPSIS OF GENERA.

Bembidium: palpi with last joint slender and preceding joint enlarged. Anillis: eyes wanting. Tachys sutural stria recurved at apex.

Pterostichus: elytra with margin interrupted, with lateral plica and with dorsal punctures. Psydrus four joints of antennæ glabrous.

Platynus: elytra obliquely sinuate at tip. Perigona: antennæ thickened beyond third joint. Calathus, and Læmosternus: claws serrate, the latter with elytral punctures.

Amara: elytra with margin interrupted, with lateral plica and with two setigerous punctures over eye. Nomius: four joints of antennæ glabrous.

Chlænius: elytra with margin interrupted and with lateral plica. Barchy-

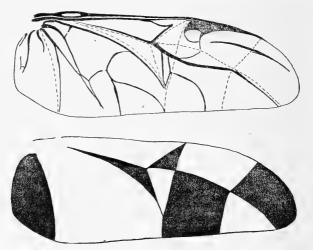


Figure 187 Wing of Carabid beetle. Black areas are reversed in folding.

lobus: mentum truncate in front.

Calosoma: palpi with last joint triangular and elytra not truncate. Scaphinotus: hind coxæ separated Carabus: third joint of antennæ not compressed.

Anisodactylus: two setigerous punctures on each angle of clypeus. Galerita: elytra truncate.

Dyschirus: body depundulate. Promecognathus: hind coxæ separated. Scarites: basal joint of antennæ long. Schizogenius: front tarsi dilated. Clivina: thorax more or less quadrate, palpi similar in the sexes.

Harpalus: two basal joints of antennæ glabrous. Babister: labium unusually short. Patrobus, Pogonus, and Trechus: with two setigerous punctures

over the eyes, the last with terminal joint of palpi acute, the second with head constricted behind the eye. Nothopus: outer angle of front tibia prolonged. Discorderus and with middle tibia arcuate and serrate within. Stenolophus, Bradycellus, and Agonoderus: penulmate joint of palpus bisetose, the first with front and middle tarsi of male bilobed, the last with mentum not toothed. Stenomorphus: body subpedunculate.

Lebia: elytra truncate at tip. Psedomorpha: head with antennal grooves. beneath. Brachynus: one setigerous puncture over eye. Zuphium, Diaphorus and Thalpius: penultimate joint of palpus pleurisetose, the first with narrow neck, the last with body subpedumculate. Ega: hind coxæ separated. Casnonia: head elongate. Tetragonoderus: tibia spurs long. Dromius, Apristus, Blechrus, Axinopalpus, Technophilus, Callida, Apenes, Cymidis, Pinacodera, Plochinus, and Philophuga: head not constricted behind the eyes, the first four with tarsi slender, the fourth with labial palpi thickened, the third and seventh with thorax lobed at base, the second and fifth with claws simple, the sixth with fourth tarsal joint bilobed, the eighth with coxæ hairy above, the ninth with terminal joint of palpi cylindrical, the tenth with base of thorax squarely truncate.

Enebria: antennæ with four basal joints glabrous; Euphorticus, Lachnophorus, and Opisthius: with two setigerous punctures over the eye, the first two with apices of elytra rounded, the first without elytral punctures. Omophron: scutellum concealed. Loricera: antennæ free at base. Metrious: elytra not margined. Notiophilus, front tibia very obliquely truncate. Leistes: mandibles explinate at sides.

Elaphrus. Trachypachus: elytra not margined at base. Diplochilla and Psydrus: elytra striate, the latter with two dorsal punctures.

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Agonoderus lineola Fabr.
pallipes Fabr.
rugicollis—pallipes.
Agonosma californicum (not Calif.)
Agonum brevicale Loxandrus.
famelicum—Platynus.
Amara foveolata Hay.
```

a foveolata Hay.
aurata Dej.
blanchardi Hay.
brunnipes Mots.
californica Dej.
conflata Lec.
erratica Sturm.
fallax Lec.
farcta Lec.
gibba Lec.
imitatrix Horn.
impuncticollis Say.
inepta—erratica.

insignis Dej. insularis Horn.

interstitialis Dej.

jacobina Lec.
natior Kirby.
longula Lec.
rectangula Lec.
remotestriata Dej.
robustula Horn.
scitula Zimm.
stupida Lec.
Anchomenus brunneomarginatus—Platinus.
ferrugineus—Platynus.

maurus—Platynus.
ovipennis—Platynus.
rugiceps—Platynus.
Anillus debilis Lec.
explanatus Horn.
Anisodactylus alternans—porosus.
amaroides Lec.
brevicollis Lec.
brunneus Dej.
californicus Dej.
confusus (undetermined).

consobrinus Lec. dilatatus Dej. flebilis Lec. hirsutus (undetermined). immanis Horn. irregularis Mots. nivalis Horn. obtusus Lec. piceus Lec. pilosus Horn. pitychorus Lec. porosus Mots. rudis-porosus. semipunctatus Lec. similis—semipunctatus. strenuus Horn. sublævis-porosus. villosus-piceus. viridescens-porosus. Anisotarsis flebilis-Anisodactylus. Apenes limbata (undetermined). nebulosa Lec. Apheloginia bilineata-Lebia. iurcata—Lebia. guthula-Lebia. Apristus laticollis Lec. cordicellis Lec. Axinopalpus biplagiatus (Dej.) californicus—biplagiatus. fusciceps Lec. Badister anthracinus Lec. ferrugineus Dej. submarinus (undetermined). Bembicidium anthostictum (undet.) Bembidium acutifrons Lec. anguliferum (Lec.) approximatum (Lec.) assimile Gyll. bifasciatum (Mots.) bifcssulatum (Lec.) breve Mots. brevistriatum Hay. californicum Hay. cautum (Lec.) carinatum Lec. coloradense-dentellum. complanulum (Man.) concinnum-perconcinnum. concolor (Kirby.) connivens (Lec.) consanguineum Hay. crurale-dubitans. dentellum (Thumb.) dubitans Lec. dyschirinum Lec.

ephippiger (Lec.) erosum-transversale. falsum Bla. flavicauda-Tachys. flavipictum-pictum. fuchsii Blais. fumatum Mots. funereum Lec. grandicolle (Lec.) henshawi Hay. hesperum Fall. horni Hay. humboldtensis Blais. incertum (Mots.) incrementum-dentellum. indistinctum Dej. insulatum (Lec.) intermedium (Kirby). irridescens (Lec.) laterimaculatum (undetermineu). laticeps (Lec.) littoralei-hesperum. longulum (Lec.) lucidum (Lec.) lugubre Lec. mæklini (not California). mexicanum (not California) mormon Hay. mundum-bifasciatum. muscicola Hay., nanus-Tachys. nebraskense Lec. nevadense Ulke. nigripes-variegatum. nigrocœruleum Hay. nitidum (Kirby.) nubiculosum Chaud. obliquum-nitidum. oblongum (Man.) obtusangulum Lec. parallelicolle (undetermined). pictum Lec. planatum Ler. planisculum Man. platynoides Hay. politum (undetermined). perconcinnum Bla. pumilus-Tachys. quadrifoveatum Man. recticolle Lec. rickseckeri Hay. scudderi Lec. sculpturatum Mots. sordidulum Chaud. sordidulum-timidum.

spectabile (Man.) deitzii Sch. striola Lec. discors Lec. subinfaltum (uidetermined). eremicola Fall. suspectum-dentellum. latipenne Horn. tigrinum Lec. luxatum Say. timidum-versicolor. parviceps Cas. transversale Dej. parvicollis Fall. trechiforme (Lec.) peregrinator Guer. vandykei Blais. prominens Lec. variegatum Say. rugosipennis Sch. variolosum Mots. scrutator Fabr. versicolor (Lec.) semilæve Lec. vile (Lec.) simplex Lec. whitneyi Fall. subæneum Chaud.. wickhami Hay. tepidum Lec. zephyrum Fail. triste Lec. Blechrus glabratus (undetermined). tristoides-triste. nigrinus (Man.) Carabus californicus (undescribed). Bomius lucidus-Blechrus. dentellum-Bembidium. Brachylobus californicus (undet.) serratus (not California). tædatus Fabr. caurinus Horn. Brachynus carinulatus Mots. truncaticolle (not California). costipennis Mots Casnonia pennsylvanica (not Calif.) fidelis Lec. picta Chaud. lateralis Dei. Celia aurata—Amara. californica-Amara. tschernikhii Man. farcta—Amara. gibba—Amara. Bradycellus californicus Lec. cognatus Gyll. imitatrix-Amara. nebulosus Lec. interstitialis-Amara. nitens-cognatus. nubifer-ruprestris. purpurescens-Amara. rectangula-Amara. rivalis Lec. ruprestris Say. remotestriata-Amara. robustula-Amara. symmetricus Mots. ventralis-ruprestris. Chlænius asperulus-variabilipes. Bradytus latior-Amara. cumatilis Lec. Brennus cordatus-Scaphinotus. cursor Chev. cristatus-Scaphinotus. glaucus Lec. dissolutus-Scaphinotus. harpalinus Esch. interruptus—Scaphinotus. leucoscellis Chev. obliquus—Scaphinotus. nebraskensis (not California). porcatus-Scaphinotus. obsoletus Lec. striatopunctatus-Scaphinotus. pennsylvanicus Say. striatus-Scaphinotus. pubescens-pennsylvanicus. Calathus behrensii-ruficollis. regularis-sericeus. rogator Mots. obscurus Lec. quadricollis-ruficollis. ruficauda Chaud. ruficollis Dei. sericeus Forst. Calleida croceicollis-Technophilis. simillimus Chaud. Callida platynoides Horn. solitarius Say. Callisthenes discors-Calosoma. sparsus Lec. tricolor Dei. Calosoma ænescens Lec. angulatum (not California). variabilipes Esch. calidum (not California). viridifrons Esch. cancellatum Esch. Clivina dentipes Dej.

oh-

sculptipenne-Scaphinotus punctulata Lec. Coptodera piceus-Dromius. liquus. sinuatus-Scaphinotus interrup-Cychrus alternatus-Scaphinotus striatopunctatus. tus. angusticollis-Scaphinotus. striatopunctatus-Scaphinotus. basalis-Scaphinotus cristatus. striatus-Scaphiotus ventricosus. catenulatus-Scaphinotus mimsubtilis-Scaphinotus. symetricus-Scaphinotus ventri-US. compositus-Scaphinotus interccsus. ruptus. truncaticollis-Scaphinotus. constrictus-Scaphinotus intervelutinus-Scaphinotus angustiruptus. collis. convergens-Scaphinotus obliquventricosus-Scaphinotus. ventricosis-Scaphinotus. us. cordatus-Scaphinotus. Cymidis abstrusa (not California). corpulentus-Scaphinotus interamœna-Philophuga. biplagiatus-Axinopalpus. ruptus. crenulatus-Scaphinotus ventricantornica cribricollis (not California). cosis. cristatus—Scaphinotus. laticollis Say. decipiens-Scaphinotus striatoplanipennis (not California). punctatus. punctigera-Pinacodera. dissolutus-Scaphinotus interviridis-Philophuga. Cyrtonotus blancaardi-Amara. ruptus. duplicatus-Scaphinotus cristacalifornicus—Amara. jacobina-Amara. tus. fuchsianus-Scaphinotus ventricvipennis-Amara. cosus. stupidus -Amara. gentilis-Scaphinotus ventricos- Diaphorus rufulus-Thalpius. tennuicollis Lec. gravidus-Scaphinotus punctat- Diplochila impressicollis Dej. Discoderus americanus (not Calif.) US. hoppingi-Scaphinotus oreophilamœnus Lec. ilus. cordaticollis Horn. incipiens-Scaphinotus rugiceps. crassicollis Horn, interruptus—Scaphinotus. Dromius biplagiatus-Axinopalpus. lativentris-Scaphinotus ventrinigrinus-Blechrus. piceus (Dej.) cosis. longipes-Scaphinotus angusti- Dischirius æneus Dej. collis. æneolus Lec. mimus-Scaphinotus. analis Lec. obliquus—Scaphinotus. aratus Lec. oreophilus—Scaphinotus. basalis Lec. opacicollis-Scaphinotus obliquconsobrinus Lec. us. gibbipennis Lec. ovalis-Scaphinotus striatopuncintiger-æneus. tatus. lævifasciatus (not California). politus—Scaphinotus interrupmarinus-obesus. patruelis Lec. tus. porcatus—Scaphinotus dissoluobesus Lec. salivagans Lec. punctatus-Scaphinotus. terminatus Lec. riversii—Scaphinotus .oreophiltridentatus Lec.

rugiceps-Scaphinotus incipiens.

truncatus Lec.

unipunctatus Fall.

viridens Fall. Loricera cærulescens-pilicornis. Ega lætula Lec. californica-semipunctata. foveata Lec. Elaphrus californicus-riparius. clairvillei Kirby. pilicornis Fabr. lævigatus Lec. semipunctata Esch. lecontei Cr. Loxandrus micans (not California). pallipes Horn. Loxopeza majuscula-Lebia. politus-lævigatus. Lymnæum laticeps-Bembidium. riparius Linn. Metabletus nigrinus-Blechrus. viridis Horn. Metrius contractus Esch. Nebria diversa Lec. .ipus lævissimus—Promecognathus. Eurytrichus debilis-Anisodactylus. eschscholtzia Mer. Euphorticus occidentalis Horn. ingens Horn. Galerita californica-lecontei. metallica (not California). lecontei Dej. ovipennis Lec. Glycerius intermedius Fall. rathvoni Lec. nitidus (Dej.) sahlbergi (not California). politus Fall. virescens Chaud. obtusus Fall. Nomius pygmæus Dej. Haplochile pygmea-Nomius. Notaphus incertus-Bembidium. Notiophilus obscurus Fall. Harpalus albionicus Man. alternans (undetermined). semistriatus (not California). caliginosis Fabr. semiopacus Esch. carbonarius Lec. sylvaticus Esch. cautus Dej. Notopus grossus compar-pennsylvanicus. Cchthedromus angulifera..Bembidium. depressicollis (undetermined). approximatus-Bembidium. fraternus Lec. bifosulatum-Bembidium. hirsutus (undetermined). cautium-Bembidium. pennsylvanicus DeG. connivens-Bembidium. dubitans Bembidium. porcsus Mots. ephippiger—Bembidium. grandicolle—Bembidium. somnulentus DeG. ventralis Lec. insulatus-Bembidium. vespertinus Cas. irridescens-Bembidium. Holciophorus ater-Pterostichus. serripes-Pterostichus. longulus—Bemi dium. lucidus. Bembidium. Hyperphas caligans-Pterostichus. striola-Bembidium. inanis-Pterostichus. timidus-Bembidium. Lachnophorus elegantulus Man. trechiforme-Bembidium. Læmostenus complanatus (Dej.) versicolor-Bembidium. Lebia angulata (undetermined). bilineata Mots. vile-Bembidium. Omophron dentatum Lec. cupripennis (not California). gilæ (not California). cyanipennis Dej. ovale Horn. cyanella Lec. Opisthius richardsoni Kirby. furcata (Lec.) goniodera Gem. Pasimachus californicus (not Calif.) mexicanus (not California) guttula (Lec.) vividans (not California). majuscula Chaud. Patrobus californicus Mots. ornata Say. septentrionis Dej. ruficollis-cyanipennis. Pelophila californica (not California). viridis Say. Leistus ferrugineus Man. Pemphus angusticollis-Scaphinotus. Limæum laticeps-Harpalus. Pericompsus sellatus-Tachys. Lymnæum laticeps-Bembidium. Perigona nigricens Dej.

Peryphus complanulus-Bembidium. concolor-Bembidium. nitidum-Bembidium. parallelocolle-Bembidium. subinflatus-Bembidium. Philophuga amœna (Lec.) castanea Horn. viridis (Dej.) Philotechnus croceicollis-Technophilnigricollis-Technophilus croceicollis. ruficollis-Technophilus croceicollis. Pinacodera punctigera (Lec.) semisulcata (Lower California). sulcipennis (Lower California). Platynus agilis Lec. bicolor-brunneomarginatus. bicoloratus Gem. brevicollis-frater. bruneomarginatus (Man.) bogemanni Gyl. californicus Lec. cinctellus-brunneomarginatus. cupripennis Say. cupreus Dej. deplanatus Lec. extensicollis Say. familicus-fossiger. ferruginosis Dej. fossiger Dej. fragilis-agilis. frater Lec. funebris Lec. jejunus Lec. larvalis (not California). maculicollis Lec. maurus Mots. micans-funebris. ovipennis Man. obsoletus-bogemanni. piceolus Lec. planipennis-fossiger. quadratus Lec. rugiceps—brunneomarginatus. simplex-extensicollis. striatus Dej. subsericeus—cupripennis. sulcatus Dei. tenebricosus Gem. variolatus Lec. Plochionus timidus Hald. Pœcilus amplicollis—Pterostichus.

talis. occidentalis-Pterostichus. splendidulus-Pterostichus. subcordatus-Pterostichus. Pogonus depressus (not California). planatus Horn. Platysma adstrictum-Pterostichus orangustum-Pterostichus. curtipenne-Pterostichus. longicalle-Pterostichus gracil. ior. luczati-Pterostichus. oregonum-Pterostichus. paralellum-Pterostichus Pur. puratus. planetum—Pterostichus. puncticolle — Pterostichus lus. trans. vicinum-Pterostichus. vitreum-Pterostichus. Pristonychus complanatus—Læmosten. inægualis (undetermined.) Promecognathus crassus-lævissimus. lævissimus Chaud. Pseudomorpha cronkhitei Horn. behrensii Horn. Psydrus piceus Lec. Pterostichus algidus,-validus. amethystinus Dej. angustus Dei. ater Dei. brunneus (not California). californicus Dej. caligans Horn. castanipes Men. cejumgenda (not California). congestus Men. contractus-castanipes. crenicollis Lec. curtipenne (undetermined). fuchsi Sch. gracilis (undetermined). gracilior Lec. herculaneus Man. hornii Lec. inanis Horn. inermis Fall. isabellæ Lec. lætulus Lec. longicolle-gracilior. luczotii (not California). lustrans Lec.

cursitor-Pterostichus occiden.

californicus—Pterostichus. tener Lec. menestriesii Mots. unicolor Dej. morionides Chaud. Stenomorphus californicus Mots. muticus (not California). Tachycellus cognatus-Bradycellus. occidentalis (Dej.) conformis Fall. oregonus (not California). nigrinus Dej. orinomum (Leach.) nitidus-Glycerius. ovicollis Sch. Tachys anthrax Lec. audax Lec. parallelus-protractus. corax Lec. planctus Lec. edax Lec. protractus Lec. purpuratus (not California). falli Hay. scutellaris Lec. flavicauda Say. serripes (Lec.) latipennis Hay. splendidulus Lec. mordax Lec. subcordatus Lec. nanus (Gyll.) tarsalis Lec. obesulus Lec. validus Dej. pumilis Dej. vicinus Lec. rapax Lec. vitreus (not California). rivularis-nanus. rufotestaceus Hay. Scaphiodactylus micans-Loxandrus. Scaphinotus angusticollis Fisch. sellatus Lec. behrensi Roesch. virgo Lec. cordatus (Lec.) vittiger Lec. incipiens-rugiceps. vorax Lec. interruptus (Man.) Trachypechys gibsii Lec. mimus (Horn.) inermis Mots. obliquus (Lec.) Technophilis croceicollis (Men.) oreophilus (Riv.) mgricollis-croceicollis. punctatus (Lec.) Tenystola striata-Platynus. rugiceps Horn. sulcata-Platynus. striatopunctatus (Chaud.) Tetragonoderus fasciatus Hald. subtilis (Schaum.) pallidus Horn. ventricosus Dei. undulatus-fasciatus. Scarites subterraneus Fabr. Thalpius rufulus Lec. Schizogenius crenulatus Lec. hornii Chaud. Trechus barbaræ Horn. depressus Lec. californicus-chalybeus. litigiosus-depresus. pluripunctatus Lec. chalybeus Dei. seticollis Fall. lævigatus-ovipennis. Selenophorus opalinus (not Calif.) oblongulum-Bembidium. palliatus Fabr. ovipennis Mots. Stenolophus anceps Lec. pomonæ Fall. spectabile-Bembidium. californicus Lec. Triæna foveolata-Amara. cincticollis Lec. longula—Amara. conjunctus say. scitula-Amara. flavipes Lec. Zuphium longicolle Lec. limbalis Lec. ochropezus Say.

HALIPLIDÆ.

Brychius hornii Cr. Cnemidotus callosus Lec. simplex Lec. Haliplus concolor Lec. longulus Lec. ruficollis DeG.

AMPHIZOIDÆ.

Amphizoa insolens Lec.

GYRINIDÆ.

This family consists of the surface feeding water beetles called "whirligig bugs" because of their very peculiar habit of swimming. They are predaceous also in the larva stage living at the bottom.

Dyneutes sublineatus (not California).

Gyretes sinuatus Lec. Gyrinus affinis Aube. confinis Lec.

parcus Say.

consobrinus Lec. fuscipes (undetermined).

plicifer Lec.

DYTISCIDÆ.

The beetles of this family are aquatic and predaceous.

Acilius laticinctus-Thermonectes bas-

latiusculus—semisulcatus. simplex-semisulcatus. semisulcatus Aube.

Agabinus glabrellus Mots.

Agabus austenii Sharp. brevicollis (Lec.) confertus (Lec.)

discolor-lecontei. erichsoni (undetermined).

intersectus (Crotch).

lecontei (Crotch.) lineellus (Lec.)

lugens Lec. lutosus-lugens. morosus (Lec.)

morulus Lec. nigroæneus Er.

obliteratus (Lec.) obsoletus (Lec.)

perplexus-suturalis.

semivittatus (not California). strigulosus (Crotch).

suturalis (Croton). tristis Aube.

Bidessus affinis Jay.

amandus Lec. cinctellus (Lec.)

nigrinus Casey. pictodes Sharp.

plicipennis (Crotch). subtilis (Lec.)

Cœlambus hydropicus Lec. lutescens Lec.

medialis Lec. Colymbetes anthrax Lec.

colloseus Lec. densus Lec. divisus Aube.

marginiventris-plicifer.

fossiger-Agabus morosus.

glabrellus Mots. inæqualis-seminiger.

sculptilis Harr. seminiger Lec.

sobrinus-Agabus nigroæneus.

strigatus Lec.

Copelatus chevrolatii Aube. Coptotomus interrogatus Fabr.

Cybister ellipticus Lec. explanatus Lec.

Cymatopterus inæqualis Horn.

Deronectes depressus Fabr. griseostriatus DeG.

striatellus (Lec.) Desmopachra latissima (Lec.)

Dytiscus anxius-circumcinctus. circumcinctus Lec.

fuscostriatus-circumcinctus.

marginicollis Lec. sublimbatus Lec.

Eretes sticticus Linn.

Gaurodytes brevicollis-Agabus.

conferatus—Agabus. intersectus—Agabus.

lecontei-Agabus. lincellus-Agabus.

lugens-Agabus. morosus-Agabus.

obsoletus-Agabus.

semivittatus-Agabus. strigulosus-Agabus. suturalis-Agabus.

tristis-Agabus.

Graphoderes cinereus Linn. occidentalis Horn.

Hydaticus mormaratus-Thermonectes. stagnalis Fabr.

Hydroporus addendus Crotch.

affinis-Bidessus. amandus-Bidessus. axillaris Lec. cinctellus-Bidessus. eximius Mots. fortis Lec. fraternus Lec. funereus Crotch. griseostriatus-Deronectes. hardyi Sharp. bydropicus-Hygrotus. impressifrons Mots. latebrosus Lec. latissimus-Desmopachra. !utescens Lec. medialis-Cœlambus. mexicanus Sharp. maculavis-affinis obesus-rivalis Gyll. obscurellus-affinis. palliatus Horn. parallelus Lec. perplexus—tenebrosus. punctinatus Horn. plicipennis-Bidessus. pulcher Mots. quadrimaculatus Horn.

subpubescens Lec. subtilis-Bidessus. tenebrosus Lec. terminalis Sharp. vilis Lec. Hydrovatus brevipes Sharp. Hygrotus hydropicus (Lec.) Hydrotrupes palpalis Sharp. llybiosoma regularis Lec. decipiens Lec. difficilis Horn. Laccophilus atristernalis Crotch. fasciatus Aube. Laccophilus atristernalis-mexicanus. quadrilineatus Horn. terminalis Sharp. truncatus Mots. Rhantus anisonynchus Crotch. binotatus Har. consimilis Mots. discedens-tostus. divisus Aube. flavogriseus Crotch. sinuatus Lec. tostus Lec. Thermonectes basilaris Horn.

RHYSSODIDÆ.

Clinidium calcaratum Lec.

serrata-Priacma.

striatellus-Deronectes.

rivalis Gyll.

Cupes lobiceps Lec.

Rhyssodes hamatus Lec.

intermedius-basilaris.

marmoratus Lec.

CUPESIDÆ.

Priacma serrata Lec.

TENEBRIONINA

OTHNIIDÆ

Elacatis longicornis-Othnius.

guttulatus Lec.

LAGRIIDÆ.

Statira subnitida Lec.

TENEBRIONIDÆ

A family of beetles most abundant in arid regions. They feed on dead vegetable matter, a few attacking stored food products.

Adelina lecontei Horn. Alaphrus riparius Linn. Alaudes singularis Horn.

Alphitobius ovatus Cas piceus Oliv. Alphitophagus bifasciatus (Say). Amphidora attenuata—Helops. funebris Cas. gregalis Cas. littoralis Esch. inquisitus Cas. Anædus rotundicollis Anemia californica Horn. lecontei Muls. Anepsius atratus Cas. longulus Lec. bicolor Cas. parallelus Cas. catenulosus Cas. pubescens Lec. pulverulenta Man. deficiens Cas. nebulosus Cas. rufipes Cas. Aphanotus brevicornis Lec. sordidus-Trichoton. sulcatus Lec. Apocrypha anthicoides Esch. clavinoides Horn. validus Cas. dyschirioides Lec. Calcar estriatus-Bius. Aræoschizus armatus Horn. Centrioptera asperata Horn. costipennis Lec. caraboides-spiculifera. exiguus Cas. muricata Lec. simulans Cas. seriata (Lec.) sulcicollis Horn. spiculifera Lec. Argoporis bicolor (Lec.) costipennis (Lec.) Centronopus parallelus Lec. Cerenospus armatusLec. inconstans Horn. bicolor-Argoporus. sulcipennis—costipennis. concolor Lec. Asida actuosa Horn. costipennis-Argoporus. ægrota Lec. costulatus Horn. angulata Lec. Chilometopon abnorme (Horn.) capitosa Horn. castaneum Cas. helopoides-Prometopium. carinata Lec. confluens Lec. Cibdelis bachei Lec. gabbii Horn. blaschkii Man. hispidula Lec. lævigatus Cas. hirsutus Lec. Cenemeplatia sericea Horn. impetrata Horn. Cnemodus testaceus Horn. lecontei Horn. Cœlocnemis californica Man. lirata Lec. dilaticollis Man. luctata Horn. magna Lec. marginata Lec. obesus Lec. morbillosa Lec. rugosa Cas. muricatula Lec. Cœlomorpha maritima Cas. obovata (Lec.) Cœlus amplicicollis Cas. obsoleta Lec. avenarius Cas. parallela (Lec.) ciliatus Esch. sordida Lec. curtulus Cas. Auchmobius sublævis Lec. debilis Cas. Batuliodes rotundicollis (Lec.) globulosus Lec. Batulius rotundicollis-Batuliodes. grossus Cas. setosus Lec. latus Cas. Bius estriatus Lec. longulus Cas. Blapstinus æqualis Cas. obscurus Cas. angusta Lec. pacificus Cas. brevicollis Lec. remotus Cas. californicus Mots. saginatus Cas. coronadensis Cas. scolopax Cas. crassus-Ulus. solidus Cas. dilatatus Lec. sternalis Cas. discolor Horn.

fuliginosus Cas.

Conibius elongatus Horn.

parallelus Lec. seriatus Lec. Coniontellus argutus Cas. Coniontis abdominalis. Lec

affinis Lec. agrestis Cas. anexa Cas. atronitens Cas. audax Cas. avenarius Cas. blaisdelli Cas. callida Cas. canonica Cas. carsonica Cas. conterta Cas. congesta Cas. conicollis Cas. convergens Cas. cuneata Cas. curtulus Cas. cylindrica Cas. cylindrica Cas. elongata Cas. degener Cas. clliptica-robusta. eschscholtzii Man. exigua Cas. expansa Cas. extricata Cas. faralonica Cas. filiola Cas. franciscana Cas. genitiva Cas. globulina Cas. gravis Cas. grossuti Cas. inæqualis Cas. inconspicua Cas. inflexula Cas. innocua-elongata. insularis Cas. elongata Cas. inornata Cas. integer Cas. lassenica Cas. lata Lec. latus Cas. levetti Cas. limatala Cas. longicollis Cas. lucidula Cas. marginata Cas. microsticta Cas. minuta Cas.

montana Cas.

nemoralis Esch. nevadensis Cas. obsidiana Cas. opaca Horn. opacicollis Cas. pacificus Fall. pagana Cas. pallidicornis Cas. paralella Cas. parva Cas. parviceps Cas. pauperculus Cas pectoralis Cas. perpolita Cas. perspicua Cas. picipes Cas. protensa Cas. pudica Cas. puncticollis Lec. remotus Fall. robusta Horn. rotundicollis Cas. punctipes Cas. rugosa Cas. shastanica Cas. sparsa Cas. strenua Cas. subpubescens Esch. suturalis Cas. suturalis Cas. symmetrica Cas. tenebrosa Cas. tenuis Cas. thoracica Cas. timida Cas. tristis Cas. truncata Cas. verna Cas. viatica Esch. Craniotus pubescens Lec. osculans Lec. depressus Horn.

Cyanæus angustus Lec.
depressus Horn.
Cryptadius inflatus (Lec.)
oviformis Cas.
punctipennis Cas.
Cryptoglossa, lævis Lec.
seriata—Centrioptera.

nigropilosa Lec.
osculans—Cratidius.
rufipes—Stenotrichius.
tenebrosa (lower California).
verrucosa Lec.

Dacoderus striaticeps Lec. Doliema plana Fabr. Echocerus cornutus-Gnathocerus.

maxillosus Fabr. Edrotes angusticollis Cas.

nitidulus Cas. ventricosus Lec.

Eleates explanatus Cas.

occidentalis Cas. Eleodes acuticauda Lec.

aspera-granulata.

armata Lec.

behrii Grim.

blanchardii Bla.

clavicornis Esch. catalinæ—omissa.

communis omissa.

confinis-dentipes.

connexa Lec.

consobrina Lec.

constrictor-parvicollis.

cuneaticollis Cas.

dentipes Esch.

depressa-Embaphion.

distans-gracilis.

elegans-dentipes.

elongata-dentipes.

elongata-grandicollis.

emarginata-omissa.

estriata-gigantea.

farallonica—parvicollis.

femorata—militaris

fischeri-marginata.

fuchsii Blai.

gentilis-gigantea.

gigantea Man.

gracilis Lec.

grandicollis Man.

granulatomuricata-humeralis.

granosa Lec.

granulata Lec. hirsuta Lec.

hispilabris Say.

hoppingii Blai.

hornii Blai.

humeralis Lec.

impotens-armata.

impressicornis-clavicornis.

inculta Lec.

intermedia-behrii. intermedia-cordata.

interrupta..omissa.

intricata-cordata.

lævis-dentipes.

laticollis-acuticauda.

lecontei Horn.

letcheri Blai.

longipillosa Horn. marginata Esch. militaris Horn.

minor-acuticauda.

muricata-humeralis. nana-tenebrosa.

neotomæ Blai.

nigrina Lec.

obscura Say.

obtusa-granulata. omissa Lec.

ordinata—pilosa.

parvicollis Esch.

parvula-letcheri.

peninsularis-omissa.

pertenuis-dentipes. pilosa Horn.

pimelioides Man.

planata—parvicollis.

producta-parvicollis

prominens-dentipes.

punctata-acuticauda.

punctata-dentipes.

pygmæa-omissa. quadricollis Esch.

reflexicollis Man.

robusta-dentipes.

scabipennis Lec.

scabricula Lec.

scabrosa Esch.

sculptilis-hispilabris. stricta-cordata.

subaspersa-lecontei.

sublævis-cordata.

subnitens Lec. sulcipennis-obscura.

tarsalis-quadricollis.

tenebrosa Horn.

tuberculata-cordata.

tuberculata—granulata. tuberculata—humeralis.

valida-grandicollis.

vandulæ-letcheri.

veseyi Lec.

vicina Lec.

Eleodimorpha volcan Bla. Embaphion pderessum Lec.

elongatum Horn.

Emmenastus ater-Melanastus.

crassicornis-Melanastus.

longulus-Hylocrinus.

nanulus-Melanastus obesus.

obesus-Melanastus.

obtusus-Melanastus.

piceus-Hylocrinus.

thoracicus Melanastus. strigicollis Horn. Epitragus pruinosus—Metopoloba. submetallicus—Polemiotus. tumescens Lec. Hylocrinus blaisdelli Cas. Esophus castaneus-Eupsophus. depressulus Cas. Eulabis bicarinatus Esch. filitarsis Cas. crassicornis Cas. longulus (Lec.) grossa Lec. oblongulus Cas. laticornis Cas. piceus (Cas.) obscurus Lec. Hypophleus opaculus Lec. substriatus Lec. pubescens Lec. rufipes Esch. Iphthimus lævissimus Cas. Eupsophius castaneus Cas. serratus Man. Eurymetopon abnorme-Metopium. Lioderma cacti Lec. atrum-Emmenastus. grandi Mars. bicolor Horn. Locrodes oblongulus-Hylocrinus. convexicolle-Metopium. piceus-Hylocrinus. cylindricum-Metopium. Megeleates sequoiarum Cas. inflatum—Cryptadium. longulum—Emmenastus. Mecysmus angustus Lec. Melanastus æquicollis Cas. obesus-Emmenastus. ater (Lec.) ochraceum-convexicolle. crassicornis (Cas.) sodalis-Telabis. exoletus Cas. rufipes Esch. lucidulus Cas. sodalis—Telabis incisa. mœstus Cas. Eusattus agnatus Cas. obesus (Lec.) obtusus (Lec.) convexus Cas. coquilletti Lin. otiosus Cas. costatus Horn. sterilis Cas. difficilis Lec. thoracicus (Cas.) dilatatus Lec. vergrandis Cas. dubius Lec. Merotemnus elongatus Horn. erplanatus Cas. Metaclisa marginalis Horn. erosus Horn. Metopium abnorme (Lec.) lævis Lec. convexicolle (Lec.) muricatus Lec. cylindricum (Cas.) edax Cas. nanus Cas. politus Horn. egregium Cas. oblongus Cas. faustum Cas. gravidum Cas. productus (Lec.) granulosum Cas. puberulus Lec. gulosum Cas. rebustus Lec. Euschides liratus-Asida. insulare Cas. obovatus-Asida. intiger Cas. molestum Cas. Gnathocarus cornutus Fabr. Helops angustus Lec. opacipenne Cas. probatum Cas. antennatus Lec. bachei Lec. tersum Cas. bliasdeli Cas. testaceum Cas. Metopoloba californica Cas. californicus Man. prumosa (Horn.) discipula Cas. Micromas maritimus Cas. edwardsii Horn. ovipennis (Horn.) opacus Lec. Microschatia inæqualis Lec. ovipennis Cas. punctatus Gem. puncticollis Lec. Mycotrogus angustus Horn. punctipennis Lec. rugulosus Lec. Nocibiotes gracilis (Cas.)

Noserus convexulus Cas. Phthora americana Horn. Phylethus bifasciatus-Alphitophagus. corrosus Cas. plicatus (Lec.) Platydema angustus Lec. Nosoderma diabolicum-Phlæodes. janus Fabr. plicatum-Noserus. oregonensis Lec. porcatum-Phellopsis obcordata. subquadrulnm Cas. pustulosum—Phlœodes diaboli-Polemiotus submetallicus (Lec.) Prometopion helopioides (Horn.) cus. Notibius gracilis-Nocibiotes. Schizillus laticeps Horn. granulatus Lec. Scotobænus parallelus-Centronopus. puberulus Lec. Sitophagus complanatus Dei. pubescens Lec. lecontei-Adelina. puncticollis Lec. Stenotrichus rufipes (Lec.) sulcatus Lec. Stibia maritima-Micromas. Nyctobates inermis-pensylvanica. ovipennis-Micromas. pensylvanica Del. Telabis fidelis Cas. Nyctoporus æquicollis Esch. incisa Cas. carinata Lec. opacella Cas. cristata Esch. sodalis (Horn.) galeata-cristata. Tenebrio estriatus-Bius. molitor Linn. pullata Cas. sponsa Cas. obscurus Fabr. tetrica Cas. tenebroides Beauv. Palecyphorus costipennis-Asida sor- Tribolium confusum Duv. dida. ferrugineum Fabr. Palorus melinus Herb. Trimytis abnorme-Chilometopon. Pentaphyllus californicus Horn. Triorphus gracilicornis Cas. Phareria debilis Lec. lævis Lec. globosa Lec. politus Cas. humeralis Cast. punctatus Lec. limbalis Horn. rugiceps Lec. pilifera Lec. subpubescens Horn. rotundata Lec. Trichoton sordidum (Lec.) montana Cas. Troglederus costatus Lec. Phalopsis obcordata tuberculatus Blai. montana Cas. Typhlusechus singularis Lin. Philonthus angulatus-Asida. nucleatus Cas. carinatus—Asida. confluens—Asida. Uloma olnquiata Lec. marginata-Metaclisa. connivens-Asida. Ulosonia marginata Lec. costipennis-Asida sordida. Ulus crassus (Lec.) hirsutus-Asida. Usechus lacerata Mots. hispidus—Asida hispidula. Vacronus tenuicornis Cas. marginatus-Asida. Zopherodes californicus Cas. muricatulus— Asida. parvicollis Cas.

CISTELIDÆ.

Allecula punctulata Lec.
Cistela opaca (Lec.)
punctulata—Allecula.
serica Say.

obsoletus-Asida.

parallelus-Asida.

Phloeodes diabolicus Lec.

remotus Cas.

variabilis Horn. Hymerorus discrepans Prionychus cyanescens—Stenochidius.

Zopherus grandicollis Horn.

induratus Cas.

nucieatus Cas.

theveneti Horn.

tristis Lec.

Prostenus californicus Horn. Stenochidius cyanescens (Lec.) Xystropus californicus gracilis Lec.

robustus Cas. opacus-Cistela.

MELOINA

MELOIDÆ.

The blister beetles are used in medicine. They feed on the foliage of plants and are sometimes quite injurious. The young larvæ are parasitic on bees and are called triungulins because of their trident-shaped claws. They have hypermetamorphoses.

SYNOPSIS OF GENERA.

Lytta: antennæ with apical joints thickened. Gnathium: mandibles prolonged beyond labrum.

Nemognatha: mandibles prolonged beyond labrum. Zonitus outer lobe of maxillæ not prolonged.

Epicauta: lower portion of claws equal to upper. Meloe: elytra short. Marrchasis: second joint of antennæ long.

Calospasta. Cysteodemus: elytra inflated. Megetra: elytra divergent from scutellum. Porespasta: elytra separating at tip. Phodaga; vertex elevated Tegrodera: body glabrous.

Calospasta elegans (Lec.) fulleri Horn. mirabilis Horn. mœsta Horn. nemognathoides Horn. perpulchra Horn. Cantharis æneipennis-Lytta. auriculata—Lytta.

chalybeata-Lytta. childii-Lytta. choris-Lytta. compressicornis-Lytta. crotchii-Lytta. cyanipennis-Lytta. difficilis-Lytta. dolorosa-Lytta stygica.

funerea-Lytta. incommoda-Lytta. infidelis-Lytta.

insperata-Lytta. lugens-Lytta. lugubris-Lytta. magister-Lytta. melæna (Arizona.) mærens—Lytta. molesta-Lytta.

morosa-Lytta. morosa-Lytta. nigripilis-Lytta.

oblita-Epicauta. puncticollis-Epicauta. purpurescens—Lytta. rathvini-Lytta. refulgens-Lytta. smaragdula—Lytta stygica. sphæricollis-Lytta. stolida-Lytta. stygica-Lytta. tenebrosa-Lytta. vulnerata-Lytta. Cysteodermus armatus Lec. wizlizeni Lec.

nitidicollis-Lytta.

Epicauta alphonsii Horn. elegans-Calospasta. fallax Horn. maculata Say.

maura (Lec.) oblita (Lec.) puncticollis Man.) straba Horn.

Gnathium nitidum Hron. Lytta æneipennis Lec. atriventris-Macrobasis. auriculata Horn. chalybeata (Gem.)

childii Lec. choris (Fall).

GUIDE TO CALIFORNIA INSECTS.

compressicornis Horn. crotchii (Horn). cyanipennis Horn. difficilis (Fall). funerea (Fall). incommoda (Horn). infidelis (Fall). insperata (Horn). lugens Lec. lugubris Ulke. magister Horn. maura-Epicauta. mærens Lec. molesta (Horn). morosa (Fall). nigripilis (Fall). nitidicollis Lec. oblita Epicauta. puncticollis-Epicauta. purpuriscens (Fall). rathvoni Lec. refulgens Horn. sphæricollis (Say). stolida (Fall.) stygica (Lec.)

tenebrosa Lec. vulnerata Lec. Macrobasis fallax Horn. Wlegetia opaca Horn. Meioe barbarus Lec. opacus Lec. sublævis Lec. strigulosus Man. Nemognatha apicalis Lec. cribraria Lec. dichroa Lec. dubia Lec. immaculata Say. lutea Lec. nigripennis Lec. piezata Fabr. scutellaris Lec. Nomaspis sublævis Horn. Phodaga alticeps Lec. Poreospasta polita Horn. Tegrodera erosa Lec. latecineta-erosa. Zonitis flavida Lec. vigilans Fall.

Dendroides picipes Horn.

PYROCHROIDÆ.

Pyrochroa californica Horn.

ANTHICIDÆ.

Amblyderus albicans Anthicus amœnuc Cas. amplicollis Boh. annectens Lec. atomarius Boh. auriger Cas. bellulus Lec. biguttulus Lec. californicus Laf. cæsiosignatus Boh. confinis Lec. corticalis Lec. cribratus Lec. formicarius Laf. hecate Cas. helvinus Cas. herifuga Cas. horridus Lec. inscitus Cas. lugubris Laf. luteolus Lec. maritimus Lec. mercurialis Cas. militaris Cas. nanus Lec. nigritulus Lec.

nitidus Boh. nitidulus Lec." obliquus Cas. obscurellus Lec. ovicollis Cas. pinguescens Cas. præceps Cas. protectus Cas. punctatulus Lec. quadrilunatus Laf. rufulus Lec. seminotatus Cas. squamosus Laf. tenius-Baulius. troglodytes Boh. Baulius tenius Lec. Crophyra abnormis Horn. bardii Horn, crotchii Horn. distinguenda Horn. flabellata Horn. funebris Horn. inconspicua Horn. lequesii Horn. monticola Horn. punctulata Lec.

Eurygenius constricta Lec. Formicilla munda Lec. Hemantus enodis Cas. floralis (Linn) Lappus bipartitus Cas. canonicus Cas. cursor Cas. nitidulus Lec. pinalicus Cas. turgidihollis Cas. vigilans Cas. Mecynotarsus delicatulus Horn. Notoxus alamedæ Cas. apicalis Lec. calcaratus Horn. cavicornis Lec. conformis Lec. constrictus Cas. debilitans Cas. denudatus Horn. elegantulus—talpa. humboldti Cas. Justrellus Cas. monodon Fabr.

robustus Cas.

serratus Lec.

Asclera cana-Oxacis.

Oxacis bicolor (Lec.)

cana (Lec.)
pallida (Lec.)

discolor Lec.

excavata Lec.

quadrimaculata Mots.

spatulifer Cas.

bicolor-Oxacis.

sparsus-conformis.

vittata Horn.

talpa Laf. Meloe floralis-Vacusus. Pedilus punctulatus-Corphyra. Phomalus saginatus Cas. Retocomus decorellus Cas. gratus Cas. Thicanus californicus Laf. franciscanus Cas. Vacusus confinus Lec. nigritulus Cas. Sapintus corticalis (Lec.) corticalis-Sapintus. obesus Cas. parviceps Cas. gracilentus Cas. salinus Lec. Stereopalpus incanus Cas. indutus Cas. impressicollis Cas. nimius Cas. pruinosus Lec. subalbicans Cac. variipes Cas. Tanarthropsis alutaceus Lec. infernalis Wic. inyo Wic. brunnipennis Lec. Tanarthrus alutaceus (Lec.)

ŒDEMERIDÆ.

pallida—Oxacis.
Ditylus cyanipennis Horn.
Ischnomera excavata—Asclera.
Nacerdes melanura Linn.
sericea Horn.
Rhinoplatia ruficollis Horn.
Xanthochroa californica Horn.

alutaceus-Tanarthrus.

PYTHIDÆ.

Cononctus macer Horn.

punctatus Lec.
sericans Lec.

Priognathus monilicornis Rand.
Salpingus alternans Lec.

Spalma quadricollis Horn.
Rhinosimus æneirostris Mann.
pallipes Boh.
Trimitomerus riversii (not California).

Myodites californicus Lec. Rhipiphorus cruentus Germ.

Anaspis atra Lec.
collaris Lec.
luteipennis—sericea.
sericea Man.

flavipennis Lec.

MORDELLIDÆ.

RHIPIPHORIDÆ.

aspersa—Mordellistena. comata—Mordellistena. Mordella rufa—Anaspis. scutellaris Fabr. vilis—Mordellistena.
Mordellistenus æqualis Sm.
aspersa (Mels.)
comata Lec.
militaris Sm.
pusio Lec.
rufa (Say.)
infima Lec.

intermixta Helm.
nubila Lec.
tosta Lec.
unicolor Lec.
vilis (Lec.)
Pentaris hirsuta Sm.
nubila (Lec.)

MELANDRYIDÆ.

Beetles of this family feed on fungi.

Carebara californica Fall.
brevicollis Fall.
Dircæa riversii—Phlœotrya.
Eustrophus indistinctus
repandus (not California).
Hallomenus scapularis Mots.
Holostrophus impressicollis Lec.
Hypulus bicincta—Phlœotrya.
riversii—Phlœotrya.
vandaueri—Phlœotria.
Lacconotus pinicolus Horn.

Marolia fulminans Lec.

Mycterus canescens Horn.
concolor Lec.
quadricollis Horn.

Nothus iuteus Horn.

Phlœotrya bicincta (Horn.)
riversi (Lec.)
vandauri Muls.

Phryganiphilus collaris Lec.
Serropalpus barbatus Schal.
Tetratoma concolor Lec.

MONOMMIDÆ.

Hyporhagus gilensis Horn.

ÆGIALITIDÆ.

Ægialites californicus (not California.) fuchsii Horn.

STYLOPIDÆ.

The Stylopidæ are parasitic upon bees and wasps. The females are larvaform. The group have been separated as a distinct order under the name Strepsiptera.

Xenos auriferi Pierce.

ELATERINA

BUPRESTIDÆ.

The Buprestidæ have been called the short horned wood borers in contrast with the Cerambycidæ. The food habits are as follows:—

Pine Acmæodera connexa, Buprestisadjecta, aurulenta, læviventris, Calcophora, Chrysobothris californica, contigua, dolata, Hippomelasgentilis, intrusa. Fir Dicerca californica, sexualis. Cedar Chrysobothrisnixa. Willow Agrilus niveiventris, politus, Anthaxia deleta,. Poplar Buprestis fasciata. Oak Agriluspolitus, Anthaxia ænogaster, Buprestis gibbsii, Chrysobothris femoratus, Polycesta californica. Mesquite Acmæodera gibbula, Chrysobothris deleta, merkeleii, octocola, Gyascutus, Polycesta velasco. Alder Dicera hornii. Fruit trees Chrysobothris femorata.

Acmæodera acuta Lec. alacris Horn.

angelica Fall. alicia Fall.

bishopiana Fall. bowditchi (not California). comata Lec. connexa Lec. coquilletti Fall. dohrni Horn. dolorosa Fall. fenyesi Fall. flavomarginaata Gray. flavosticta Horn. gemina Horn. gibbula Lec. guttifera Lec. hepburnii Lec. hæmorrhoa-stellaris. immaculata-pulchella. jocosa Fall. lanata Horn. lareæ Fall. labythrinthica Fall. morbosa Fall. mariposa Horn. nebulosa-gemina opacula (not California). plagiaticauda Horn. porosa Fall. postica Fall. pubiventris Horn. pulchella Herb. quadrivittata Horn. quadriseriata Fall. robusta Horn. stellaris (not California.) tuta Horn. vandykei Fall. variegata Lec. versuta-guttifera. Actenodes acornis Say.

mendax Horn. Agrilus angelicus Horn. blandus Horn. gibbicollis Fall. illectus Fall. iacobinus Horn. lacustris Lec. niveiventris Horn. obolinus Lec. politus Say. walsinghami Cr.

Ancylochira aphricans-Buprestis. connexa—Buqrestis. gibbsii—Buprestis. læviventris —Buprestis. rusticum-Buprestis maculiventris.

villosa Lec. Anthaxia æneogaster L. & G. ænescens-æneogaster. cyanella (not California). deleta Lec. expansa-æneogaster. foveicollis-eneogaster. nanula-æneogaster. quercata Fabr. simuala-æneogaster. strigata-æneogaster.

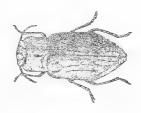




Figure 188. Buprestid beetle and larva.

Buprestis adjecta Lec. apricans (not California). aurulenta Linn. confluens Say. connexa Horn. fasciata Fabr. fulvoguttata-Melanophila. gibbsii (Lec.) læviventris Lec. langii—fasciata. lauta-aurulenta. longipes-Melanophila. maculiventris Say. subornata Lec. rusticorum—maculiventris.

Calcophora angusticollis Lec. planicosta-Gyascutus. Chrysobothris æneola Lec.

californica Lec. caurina Horn.

carinipennis Lec. contigua Lec. cuprascens Lec. cyanella Horn. debilis Lec. deleta Lec. deserta Horn. dolata Horn. errans Gorv. femorata Fabr. ludificata Horn. mali Horn. merkeleii Horn. monticola Fall. nixa Horn. octocola Lec. prasina Horn. pubescens Fall. purpurifrons Mots. scabripennis L.& G. semisculpta Lec. sylvania Fall. texana Lec. viridicyanea Horn.) vulcanica-californica. Chrysophana placida Lec.

hornii Cr. pectorosa Lec. prolongata Lec. sexualis Cr. Dystaxia murrayi Lec. Clyposcelimorpha marmorata Horn. Gyascutus ealifornicus-Hippomelas. cœlatus-Hippomelas. cuneatus Horn. obliteratus Lec. planicosta (Lec.) Hippomelas californicus (Horn.) cœlatus Lec. appendiculata Fabr. consputa Lec. fulvoguttata (Har.) gentilis Lec. guttulata Gebl. intrusa Horn. longipes Say. Polycesta carifornica Lec. velasco L.& G. Ptosima walshii Lec. Schizopus lætus Lec. sallei Horn. Taphrocerus gracilis Say.

THROSCIDÆ.

Aulanothroscus validus (Lec.) Drapetes plagiatus (Boh.) Lissomus plagiatus—Drapetes. Pactopus hornii Lec. Throscus mendax Horn.

Dicera californica Cr.

parvulus Lec. sejunctus Horn. sericieus Lec. validus—Aulanothroscus.

hispidus Lec.

ELATERIDÆ.

The larvæ of the Elateridæ are known as wire worms and the species living in the ground feed on the roots of plants and are very injurious. Many of the members of this family live in rotten wood.



Figure 189. Wire worm, the larva of an Elaterid.

Adelocera cavicollis—profusa.
profusa Cand.
sparsa Cand.
rorulenta Lec.
Agriotes apicalis Lec.
californicus—Dolopus.
ferrugineipennis Lec.
fucosus Lec.

imperfectus Lec.
inversus Cand.
nevadensis Lec.
opaculus Lec.
protractus—Leptoschema.
sparsus Lec.
subustus—Dolopius lateralis.
thevenetii Horn.
torquatus Lec.
Alaus melanops Lec.
Anamesus convexicollis—Aplastus optatus.
Anchastus bicolor Lec.
cinereipennis Man.

desertus Horn.
militaris Cand.
puberulus—cinereipennis.
recedens—cinnereipennis.
regularis—cinereipennis.
tantilus—cinereipennis.
tus angusticollis Horn.

Aplastus angusticollis Horn.
corymbitoides Horn.
molestus Horn.
optatus Lec.
serratus Lec.
speratus Lec.
tenuiformis Horn

Aphricus californicus Lec.
Asaphes carbonatus Lec.
caricinus—carbonatus.
dilaticollis Mots.
hirtus Cand.

morio Lec. tumescens Lec. verna-morio.

Athous agriotoides Fall.
aterrimus Fall.
axillaris Horn.
discors—discrepans,
discrepans Reitt.
excavatus Mots.
falli Reit.
ferruginosus Esch.

ferruginosus Escimitatus Fall. ingens Fall. limbatus Lec. nigripilis Mots. nugalis Fall. opalinus Cand. palpalis Fall. polygenus Fall.

quadricollis—falli.
recticollis—rectithorax.
rectithorax Reit.

rectithorax Reit. scissus Lec. vittiger Lec.

Camphylus fulvus Mots. Cardiophorus abbreviatus Bland.

ameus Horn.
amplicicollis Mots.
bifasciatus Blanch.
californicus—Limonius.
carbonatus Blanch.
coxalis Blanch.
crinitus Blach.
dispar Blanch.
edwardsii Horn.
fenestratus Lec.
fulvipes—tenebrosus.

gemmifer Blanch.
inanus—Horisonotus.
latiusculus Esch.
longior Lec.
luridipes Cand.
mimeticus Horn.
obscurus Lec.
seniculus Blanch.
stigmaticus Cand.
sufflatus—Horisonotus.
tantillus—Anchastus.
tenebrosus Lec.
transfugus—Horisonotus.
tumidicollis Lec.

Chalcolepidus rubripennis Lec. smaragdinus Lec. tarsatus Fall.

webbii Lec.
Corymbetes æripennis Kirby.
angularis Lec.

anthrax Lec. bombycinus-fallax. brewerii Horn. carbo Lec. caricinus Germ. colossus Lec. conjugens Lec. cribrosus Lec. cruciatus Linn. diversicolor-rotundicollis. edwardsii-cruciatus. excavatus Lec. exclamationis Fall. fallax Say. fraternus Lec. fertivus Lec. fusculus Lec. inflatus Say. iaculus Lec. leucaspis Germ.

jaculus Lec.
leucaspis Germ.
linearis Fall.
macer Fall.
maurus Lec.
mirabilis Fall.
miserabilis Fall.
morens Lec.
monticola Horn.
nigricans Fall.
nigricollis Bland.
nubilis—propola.
oblongoguttatus Mots.
obscurus Lec.
obversus Horn.
ochreipennis Lec.

opaculus Lec.

polygenus-Athous. phelpsii Horn. propola Lec. rhodopus Lec. turbulentus-Megapenthes. pruininus Horn. rotundicollis Say. variegatus Boh. rufipennis Fall. Elatrinus anthrax Horn. rupestris Germ. Esthesops dispersus Horn. semiluteus-fallax. Euthesanius lautus Lec. semivittatus Say. pretiosus Lec. serraticornis-colossus. Horistonotus basalis Horn teres Lec. definitus Horn. tigrinus-triundulatus. gracilis Horn. triundulatus Rand. inanus (Lec.) umbripennis Lec. simplex Lec. xanthomus Horn. sufflatus (Lec.) Cryptchypnus cinereipennis- Anchastransfugus (Lec.) Hypnoides caurinus Horn. tus gicolor Esch. choris Say. cucullatus Horn. colon Horn. funebris Cand. funebris-Cryptohypnus. gradarius—Hypnoideus. dispersus Horn. inops-Hypnoideus pectoralis. dubius Horn. nocturnus Esch. gradarius Horn. ornatus-Hypnoideus. nocturnus-Cryptohypnus. pectoralis—Hypnoideus. ornatus (Lec.) quadricollis Lec. pectoralis (Say.) squalidus Lec. striatulus (Lec.) striatulus-Hypnoideus. Ischiodontus ferreus Lec. tantillus-Anchastus. Leptoschema protractum Horn. Dicrepidius corvinus Cand. Lepturoides fulvus-Campylus. Dolopius californicus—iateralis. Limonius angulatus Mots. lateralis Esch. californicus (Man.) simplex—lateralis. clypeatus Mots. subustus-lateralis. canus Lec. Drasterius comis Lec. consimilis Walk. elegans (not California). cribricollis Horn. grandicollis Horn. crotchi Horn. livens Lec. discoideus Lec. præses Cand. discollis-maculicollis. siminolus Cand. fulvipes Fabr. Elater affinis Lec. fulvipilis Cand. apricatus Say. hispidus-californicus. ater Lec. humeralis-ornatulus. atripennis Horn. infuscatus-pilosus. behrensi Horn. maculicollis Mots. carbonicolor (not California) mandibularis-discoideus. cordatus Horn. mirus Lec. cordifer Lec. nitidulus Horn. occidentalis Cand. dimidiatus Lec. fastus Lec. ornatulus Lec. hepaticus Mels. pilosus Lec. horni Cand. quadrimaculatus-Majapenthes. ignobilis Boh. subauratus Lec. Ionaicornis Lec. subcostatus-canus. melinus Lec. ulkei-mirus. mærens Lec. pilosus Lec.

vernalis Fall. Ludius ater Cand. iecontei Horn. pinguis Horn.

Megapenthes aterrimus Horn.

elegans Horn.
lepidus Lec.
mœreus Lec.
nigriventris Lec.
quadrimaculatus Horn.
rogersi Horn.

stigmosus Lec. tartareus Lec. turbulentus (Lec.)

Melanactes densus Lec.
procerus (not California).
schaumi—Plastocerus.

Melanotus cribricollis Cand. erro Lec. longulus Lec.
oregonensis Lec.
variolatus Lec.
Meristhus cristatus Horn.
Monocrepidius comis Lec.
sordidus (not California).
Oxygomus ater Horn.
Percthops cervina Esch.
witticki Lec.
Phlegon ouqueti (not California).
herculeanus (not California)
Pityobius murrayi Lec.
Plastocerus frater—schaumii.
megalops Fall.
schaumii Lec.

Serocesomus debilis Lec. flavipennis—debilis. Tricrepidius triangulicollis—Is

Tricrepidius triangulicollis—Ischlodontus.

EUCNEMIDÆ.

Anelastes druryi Kirby.
latereillei—druryi.
Cryptosoma dohrnii—Palæoxenus.
Dromiolus basalis (Lec.)
californicus Bom.
hospitalis Blanch.
nitens Horn.

Eucnemis americana Horn. Fornax pasalis—Dromeolus. Melasis rufipennis Horn. Palæoxenus dohrnii (Lec.) Sarpedon scabrosus Bonv. Xylobius cylindriformis Horn.

CEROPHYTIDÆ.

Cerophytum convexicolle Lec.

CANTHARINA.

CANTHAR!DÆ.

This family has been more commonly known under the names Telephorida and Lampyrida. The latter name applying particularly to the group that emit light and are popularly known as fireflies. All the members of the family are predaceous.

Calochromus dimidiata (Lec.)
Calopteron reticulatum (Fabr.)
Cenophengus debilis Lec.
Dictyoptera dimidiata—Calochromus.

lætus—Eros.
Ditemus obtusus Lec.
Ellychia californica Mots.
corrusca Linn.
Eros lætulus (Mots.)
Lamprorhiza riversi Lec.
Lampyrus corrusca—Ellychia.
Lucidota californica—Pyropyga.
Lycus reticulatum—Calopteron.

Malthinus fusculus-Malthodes.

Malthodes arbustorum Keis.
fragilus Lec.
fusculus Lec.
laticallosis Lec.
transversus Lec.
Malthacus latimanus—Podabrus.
Mastinoceru opacus
Malthetius theveneti Lec.
Microphotus angustus Lec.

Maithetius theveneti Lec.
Microphotus angustus Lec.
Phengodes integripennis—Zarhippus.
Photinus californicus—Ellychnia.
reversus Gem.

Podabrus binotatus Lec. bolteri Lec.

cavicollis Lec. cinereipennis Mots. comes Lec. corneus Lec. latimanus (Mots.) lutosus Lec. macer Lec. melifluus-latimanus. mellitus Lec. pruinosus-tomentosus. tejonicus Lec. tomentosus Say. xanthoderus Lec. Polemius languidus Horn. Pterotus obscuripennis Lec. Pyropyga fenestralis (Mels.) indicta Lec.

Silis cava Lec.

filligera Lec.

lutea Lec. pallida Man. Telephorus concors Lec. divisus Lec. fraxini Say. grandicollis Lec. lautus Lec. notatus Man. ochropus Lec. peregrinus-notatus. tibialis-concors. tibiellus Gem. transmarinus Mots. Zarhipis integripennis (Lec.) piciventris Lec. riversi Horn.

ater—Trichochrous.

Adasytes laciniatus Cas. Allonyx denudatus Cas. disjunctuh Cas. sculptilis (Lec.) Anthocomus basalis-Attalus. cinctellus—Attalus. difficilis- Attalus. lobatus-Attalus lobatulus. submarginatus-attalus. Atelestus abdominalis (Lec.) basalis-Enerdes. colleris-Enerdes. Attalus basalis (Lec.) cinctus (Lec.) difficilis (Lec.) elegans Horn. lobatulus Lec. oregonensis Horn. rostratus Horn. rufomarginatus (Mots.) setosus Horn. submarginatus (Lec.) transmarinus Fall. trimaculatus (Mots.) unicolor Horn.

Biturosomus rufipes—Trichochrous grisseus.

Charlessa dichroa Lec.
elegans Horn.
Charopus hamifer Kies.
longicollis—Microlepus.
mæreus—Microlepus Mots.
uniformis Mcts.

Collops argutus Fall. cribrosus Lec.

MALACHIDÆ.

crusoe Fall.
histrio Er.
insulatus Lec.
marginellus Lec.
marginicollis Lec.
punctulatus Lec.

ruficornis Lec.

Dasyrhadus impressicollis Fall.

Dasytastes bicolor Cas.
catalina: Cas.
dispar Cas.
insularis Fall.
otiosus Car
remissus Cas.

Dasytellus inconspicuus Cas. Dasytes ænescens-Trichocarous. antennatus-Trichochrous. californicus-Trichochrous. brevicornis-Trichochrous. brevipilosus-Trichochrous. breviusculus Mots. canescens-Listrus. clementæ Fall. conformis-Trichochrous. constrictus-Eschatocrepis. cruralis (Lec.) cylindricus-Trichochrous. difficilis-Listrus. dissimillis Cas. expansus Cas.

fastidiosus Cas.
fulvitarsis—Trichochrous.
fuscus—Trichochrous.
grandiceps—Trichochrous.
griseus—Trichochrous.

hirtellus-Trichochrous. rotundicollis (Lec.) laticollis-Trichochrous. subæneus Cas. luteipes-Listrus. tibialis Mots. macer Cas. tritus Cas. minutus Cas. Malachius acutipennis Fall. motschulskei-Listrus. apicalis Mots. musculus Fall. auritus Lec. nitens Cas. bakeri Fall. parvicollis-Trichochrous. biguttatus Horn. pedalus-Trichochrous. direcus Fall. obscurellus-Listrus. inornatus Fall. piceus Lec. longiceps-Thanaops. punctipennis-Trichochrous. macer Horn. pusillus Lec. mirandus (Lec.) rotundicollis-Listrus. mixtus Horn. sculptilis-Allonyx. nigrinus Fall. seminidus Lec. pristinus Faii. sordidus-Trochochrous. prolixicornis Fall. squalidus-Trichochrous. spinipennis Horn. suturalis-Trichochrous. thevenetii Horn. umbratus-Trichochrous. ulkei Horn. Ebæus bicolor Pseudobæus. unicolor Mots. submarginatus-Atalus. viridulus Fall. Encodes abdominalis Lec. Pristoscelis ænescens-Trichochrous. basalis (Lec.) antennatus-Trichochrous. collaris Lec. ater-Trichochrous. Eschatocrepis constrictus Lec. mœrens (Lec.) Eudasytes amplus Cas. Pseudobænus bicolor (Lec.) ursinus Cas. Melyria flavipes-Euryelmir. Eurelymus flavipes Lec. Microlipus laticeps Lec. Harpalorhinus biguttulus-Malachius. longicollis (Mots.) mirandus-Malachius. brevicornis—Trichochrous. Listrus amplicollis Cas. brevipilosus-Trichochrous. brevipilossus—Trichochrous. californicus—Trichochrous. annulatus Cas. balteelus Cas. canescens (Man.) conformis-Trichochrous. confusus Cas. cruralis-Dasytes. constricticollis-Eschalocrepis cylindricus-Trichochrous. fulvotarsis-Trichochrous. constrictus. definitis Fall. fuscus-Trichochrous. densicollis Cas. grandiceps Lec. difficilis (Lec.) griseus-Trichochrous. hirtellus Trichochrous. laticollis—Trichochrous. extricatus Cas. famelicus Cas. fidelis Cas. oregonensis—Trichochrous. pedalis-Trichochrous. incertus Cas. punctipennis-Trichochrous. interruptus Lec. quadricollis-Trichochrous. interstitialis Cas. luteipes (Lec.) rufipes-Trichochrous. sordidus-Trichochrous. maculosus Cas. molannus Cas. suturalis-Trichochrous. motschulskyi (Lec.) tejonicus—Trichochrous. obscurellus (Lec.) umbratus-Trichochrous. pardalis Cas. Rhadalus testaceus Lec. Scalopterus trimaculatus-Attalus. punctatus Mots.

Thanops abdominalis Lec. longiceps Lec. Trichochrous ænescens (Lec.) agrestus Cas. antennatus (Mots) apicalis Cas. ater (Bald.) barbaræ Cas. brevicollis Lec. brevicornis (Lec.) brevipillosus (Lec.) brevis Cas. californicus (Mots.) compactus Cas. conformis (Lec.) conspersus Cas. curticollis Cas. cuspidatus Cas. cynildricus (Mots.) discipulus Cas. fallax Cas. femoralis Cas. fimbriatus Cas. fraternus Cas. fulvotarsis (Bland.) ... fulvescens Cas. fuscus (Lec.)

insignis Cas. irrasus Cas. laticollis (Man.) lobatus Cas. mucidus Cas. nigrinus Cas. nubilatus Cas. parvicollis (Man.) pedalis Lec. politus Say. prominens Cas. propinguus Cas. pruinosus Cas. punctipennis (Lec.) quadricollis Lec. remotus Cas. rusticus Cas. segaratus Cas. sinuosus Cas. sobrinus Cas. sordidus (Lec.) squalidus (Lec). stricticollis Cas. subclavis Cas. suffusus Cas. suturalis (Lec.) tectus Cas. transversus Cas. umbratus (Lec.) vilis Cas. villosus Cas. Vectura longiceps Cas.

RHIPICERIDÆ.

Sandalus californicus Lec.

griseus (Lec.)

indigens Cas. innocens Cas.

histrix Cas.

hirtellus (Lec.)

DASCYLLIDÆ.

The beetles of this family are predaceous on other insects. Allopogon villosus Horn. Anchyteis velutina Horn. Anorus piceus Lec. Cantheris variabilis-Cyphon. Dascyllus davidsonii Lec. lumbus Horn.

Euryopogon californicus Horn. Euscaphurus salteror Cas. confusus Mels. Macropogon testaceipennis Mots. Placonycha edwardsii (Lec.) Stenocolus scutellaris Lec.

HELODIDÆ.

Acneus quadrimaculatus Horn. Cyphon brevicollis Lec. concinnus (Lec.) exiguus Horn. variabilis (Thunt.)

Eucinetus infumatus Lec. Helodes apicalus Lec. brevicollis-Cyphon. concinnum-Cyphon. Scirtes califoricus Wots.

Dichranopselaphus edwardsii-Placonycha

CLERINA.

CISIDÆ.

Cis dichroa Lec. vitula-Ennearthron. Enneathron californicum Cas. vitulus Man.

CLERIDÆ.

The beetles of this family are predaceous on other insects.

Aulicus nero Spin. Chartessa dichroa Lec. elegans Horn.

Chlerus abruptus Lec. carbonarius Spin. cinctipennis Spin. eximius Man. interceptus Spin. mæstus KI. nigroventris Lec. quadrisignatus Say. repandus-Thanasimus. ruflpennis Spin.

signaticollis Spin. sphegeus Fabr. Corgnates marginellus Chev. ruficollis Fabr.

Cregya fasciata Lec.

Cymatodera angustata Spin. balteata-undulata. californica Horn. cylindricollis Chev. fuscula Lec. morosa Lec.

ovipennis Lec. pilosella-ovipennis. punctata Lec. puncticollis Bland. undulata (Say.) usta-cylindricollis.

Elasmocerus californicus Fall. Enopium dichroum-Chartessa. Hydnocera bicolor Lec.

discoidea Lec. robusta Horn. scabra Lec.

Lebasciella maculicollis Lec. marginella—Corgnates. Necrobia ruficollis-Corgnates. Perilyptus carbonarius Spin. Tillus undulata-Cymatodera.

Trichodes bimaculatus Lec. ornatus Sav.

tenellus-ornatus. Trogodendron edwardsii Horn.

Thanasimus dubius Fabr. duglasianus White. eximius-Clerus. nigriventris-Clerus. repandus Horn. rubriventris Lec.

granosa Lec.

PTINIDÆ.

The beetles of this family are predaceous on other insects.

Gibbium psylloides Cze. Mezium americanum Lap. Trigonogenius farctus-globulum. globulum Sol. Niptus ventriculus Lec. Ptinus aganatus Fall. alternatus Fall. californicus Pic.

cælebs Fall. cognatus Fall.

eximius Fall. fallax Fall. fur Linn. quadolphei Pic. interruptus Lec. quadrimaculatus (not Calif.) vergrandis Fall. verticali Lec. Hedobia angulata Fall.

ANOBIIDÆ.

The beetles of this family are predaceous on other insects. Actenobius macer Cas. pleuralis Cas.

saginatus Cas. luteotectus-Catorama. Anobiopsis sericans Fall. palliaus-Catorama. Anobium quadrulum Lec. pusillus-Catorama. Catorama conjunctum Fall. Lasioderma serricorne Fabr. exiguum Fall. opaculus Lec. gemiatum Fall. parvulus-opaculus. gibbulum Fall. planicollis Lec. latum Horn. striatus Mels. luteotectum Fall. Megorama frontalis Lec. mancum Fall. ingens Fall. nubilum Fall. Hadrobregmus gibbicollis Lec. obsoleta-latum. laticolli Fall. palliatum Fall. viduum Fall. pusillum Lec. Oligomerodes catalinæ Fall. vestitum Fall. occidentalis Fall. Cœlostethus quadrujus Lec. Oligomerus californicus Fall. truncatus Fall. Ozognathus cornutus Lec. Paralobium mundum Fall. Cœnocara californica Lec. Petalium bistriatum (not California). occidens-californica. Calposternus tenuilineatus Horn. californicum Fall. Pitnus pygmæus Gor. Dinapate wrightii Horn. Dorcatoma intiger Fall. Pnitodes setifer Lec. Ptilinus acuminatus Cas. pusillus-Catorama. Sitodrepa panicea Linn. Ernobius alutaceus Lec. Sphæricus gibboides Boie. callaris Fall. convergens Fall. Theca profunda Lec. crotchil Fall. striatopunctata—Calopsternus. debilis-punctultaus. Trichodesma beyeri Fall. marginicollis Lec. cristata Cas. montanus Fall. Trypopitys punctatu Lec. nigrans Fall. Vrilletta blaisdelli Fall. pallitarsis Fall. convexa Lec. punctulatus Lec. expansa Lec. murrayl Lec. socialis Fall. trapecoideus Fall. plumbea Fall. Euceratocerus macer—Actenobius. Xestobium affine Lec.: pleuralis-Actenobius. Xeranobium desertum Fall. macrum Fall. saginatus-Actenobius. Xyletinus distans Fall. Eupactus pudicus (undetermined) Eutylistus ulkei Fall. fucatus Lec. lugubris (not California). Euvrilletta xyletinoides Fall. Exopioides incisa-Polycaon confertus Xyletomerus histricus Fall. puberulum (undetermined). Ga tralls marginipennis Lec. Hemiptychus intiger-Dorcatoma. Zarifa insularis Fall. latus-Catorama.

BOSTRYCHIDÆ.

Sinoxylon declive Lec.
sericans Lec.
sextuberculatum Lec.
suurale Horn.

PSOIDÆ.

Acrepis quadrisignata-Psoa.

Bostrychus californicus Horn.

Dinoderus truncatus Horn.

Amphicerus fortis Lec. punctipennis Lec.

teres Horn.

Polycaon confertus Lec.

punctatus Lec. stoutii Lec. Posa maculata Lec. quadrisignata Horn. basalis Lec. ramicornis Cas.

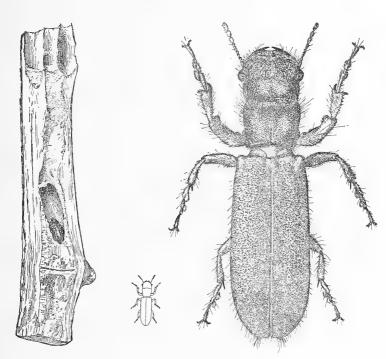


Figure 190. Polycaon confertus, and a grape twig showing work of larva.

LYCTIDÆ.

Tragoxylon californicum Cr.

SPHINDIDÆ.

Odontosphindus clavicornis Fall.

HYDROPHYLINA

HYDROPHILIDÆ.

Berosus californicus Mots.
exilis Lec.
infuscatus Lec.
miles Lec.
punctatissimus Lec.

rugulosus Horn.
salinus Fall.
subsignatus Lec.
Brachypalpus infuscatus—Creniphilus.
Cercyon capillatus Lec.

depressus Steph. fimbriatus Man. fulvipennis Man. lateralis Marsh. lugubris Payk. luniger Man. navicularis Zim. nigriceps Marsh. quisquilius Linntristis III. arthria minor

Chætarthria minor nigrella Lec. pallida Lec.

Creniphilis dissimilis (Horn).
infuscatus Mots.

rufiventris (Horn.) subcupreus (Say.)

Cyclonotum cacti—Dactylosternum.
Cymbiodyta dorsalis (Mots.)

imbellis (Lec.)

punctatostriata (Horn.) Dactylosternum cacti Lec. Helochares normatus (Lec.)

Helophorus alternatus—angustulatus.

angustulus Man. fortis Lec. obscurus Lec. pallens Cas.

Hydræna pennsylvanica Kines. Hydrobius castaneus—infuscatus.

cuspidatus—Phylhydrus.
dissimilis—Creniphilus.
dorsalis—Cymbiodyta.
fuscipes Linn.
infuscatus (Mots.)
latus Horn.
nebulosus—Phylhydrus.
scabrosus Horn.

rufiventris—Creniphilus.

Hydrocharis glaucus Lec.

lineatus—Ochthebius.
obtusatus Say.

Megasternum posticatum Man.
Phylhydrus californicus Horn.
Limnebius piceus Horn.
Limnocharis piceus—Limnebius
Hydrochus vagus Lec.
variolatus Lec.

Hydrophilus californicus—Tropisterdorsalis Brul. ellipticus—Tropisternus.

limbalis—Tropisternus. subcupreus—Creniphilus. triangularis Lec.

Laccobius ellipticus Lec.
carinatus Lec.
cristatus—nebulosus.
cuspidatus (Lec.)
diffusus Lec.

fuscus—perplexus.
hamiltoni Horn.
imbellis—Cymbiodyta.
latiusculus—californicus.
latiusculus—nebulosus.

nebulosus Say.
rormatus—Helochares.

pectoralis—nebulosus.
perplexus Lec.
punctatostriata—Cymbiodyta.

Ochtheblus costipennis.
cribricollis Lec.
discretus Lec.
fossatus—nitidus.
holmbergi Man.
interruptus Lec.
lævipennis Lec.
lineatus (Lec.)
nitidus Lec.
puncticollis Lec.
vectus Lec.

sculptus Lec.
Tropisternus apicipalpus Chev.
californicus Lec.

limbalis (Lec.)

SCARABÆINA

SCARABÆIDÆ.

This family includes the dung beetles and a series of plant feeding forms known as May beetles, June beetles, Cock chafers, Rise beetles, etc. The larvæ are called white grubs.

Ægialia blanchardi Horn.
Cœlatus—Psammodius.
conferta Horn.
crassa Lec.

Amechanus serratus—Bradycinetus.
Amphicoma canina (Horn.)
cooperi—canina.
edwardsii Horn.

rathvoni (Lec.) rotundata (Lec.) ursina (Lec.) socialis Horn. Anomæa centralis Lec. Copris mœchus Lec. Aphodius abditus-Atænius. Cotalpa granicollis Hald. aleutus Esch. ursina Horn. alternatus (Horn). Cœnonycha elementina Cas. blaisdeli-sparsus. parvuula Fali. cadaverinus (undetermined) rufescens Horn. cogregatus Man. Cremastochilus angularis Lec. consociatus Horn. crinitus Lec. conspersus Horn. depressus Horn. coquilletti Lin. ineptus Horn. cribratus Lec. pilosicollis Horn. gentilis Horn. pianatus Lec. granarius Linn. quadrauus Fall. hamatus Say. schaumii Lec. inutilis Horn. westwoodi Horn. lividus Oliv. wneeleri Lec. luxatus Hern. Cyclocephala dimidiata Burm. militaris Lec. hirta Lec. neotomæ Fall. immaculata Burm. nevadensis Horn, longula Lec. ochreipennis Horn. villosa Burm. Dasydera cooperi-Amphicoma ursina. opacus Lec. ovipensis Horn. rathvoni---Amphicoma. pardallis Lec. ursina-Amphocoma. rubidus Lec. Dichelonycha clypeata Horn. crotchii Horn. rugifrons Horn. sparsus Lec. decolorata Fall. steracorator-Atænius. fulgida Lec. subæneus Lec. fuscula Lec. unquiculus Fa!!. lateralis Fall. vittatus Say. longiclava Fall. Atænius abditus (Hald.) muscula Fall. californicus Horn. nana Fall. desertus Horn. pallens Lecpectoralis Lec. gracilis Mels. lobatus Horn. pusilla Lec. rotundata—Cœlonycha. oblongus orn. steracora or (Fabr.) truncata Lec. Bolbocerus hornii (Riv.) valida Lec. serratus—Bradycinetus. vicina Fall. Diplotaxis angularis Lec. Bradveinetus hornii-Bolbocerus. Camptorhina seratina Lec. brevicollis Lec. californica-subangulata. Canthon corvinus-simplex. humeralis-simplex. corvina Lec. lævis (not California). fimbriata Fall. militaris—simplex. levicoxa Fall. perplexus Lec. mæ ens Lec. puncticollis (Lower California). pacata Lec. sierriæ Lec. simplex Lec. Chalepus obsoletus Lec. subangulata Lec. cylindrica (Esch.) tenebrosa Fall. lacustris Lec. tenius Lec. Dynacoma marginata Cas. latispina Lec.

Euphoria californica (not California.) staff Sch. verticollis Horn. ulkei (not California.) Euryomia californica (not California). Plectrodes blaisdelli Cas. fasciatus (not California). carpenteri Lec. Geotrupes occidentalis Horn. fieldi Fall. Gymnopyge hopliæformis Lin. fossiger Cas. hopliæformis Lin. palpalis Horn. Hoplia callipyge Lec. pistoria Cas. convexula—pubicollis. pubescens Horn. dispar Lec. riversi Cas. irrorata-pubicollis Lec. squamosa Cas. Pleurophorus cæsus Panz. pubicollis Lec. sackeni Lec. Plusiotus gloriosa (not California.) Lachnosterna dubia Smith. Polyphylla cavifrons Lec. errans Lec. crinita Lec. decemlineata (Say). fusca (Fro.) lenis Horn. Psammodius coelatus (Lec.) mucoreus-Listrochelus. cylindrica—Ægialia. Lichanthe canina-Amphicoma. nanus (DeG.) edwardsii-Amphicoma. Rhyssemus californicus Horn. Scarabæus lævis-Canthon. Ligyrus californicus—gibbosus. gibbosus DeG. nanus-Psammodius. Serica alternata Lec. Listrochelus mucoreus (Lec.) Megasoma thersites (Lower Calif.) .. anthracina Lec. Melolontha 10-lineata—Polyphilla. elongatula Horn. Ochodæus californicus Horn. fimbriata Lec. estriatus Sch. lateralis Csch. gnatho Fall. mixta Lec. robusta Lec. Odontæus obesus Lec. Oncerus floralis Lec. sericatus Mots. Orsonyx anxius Lec. serotina Lec. Oxyomus alternans—Atænius. silaceus Say. cadaverinus-Aphodius. simplex Mots. valida Har. gracilis-Atænius. Thyce blaisdelli-Plectrodes. Pachyplectrus lævis Lec. Phæochrous behrensii (not Calif.) fossiger-Plectrodes. hartfordi-Plectrodes. Plectrodes blaisdelli Cas. Phileurus illatus Lec. marginata-Dinacoma. palpalis-Plectrodes. Phobetus comatus Lec. centralis-comatus. pistoria-Plectrodes. Pleocoma australis Fall. pulverea-Plectrodes. adjuvans-staff. riversi-Plectrodes. behrensii Lec. squamosa-Plectrodes. conjugens Horn. Trox atrox Lec. edwardsii-staff. fascifer Lec. fimbriata Lec. gemmulatus Horn. hirticollis Sch. punctatus Germ. hoppingi Fall. suberosus Fabr. puncticollis Riv. Tryssus comatus-Phobetus.

LECANIDÆ.

Valgus californicus Horn.

rickseckeri Horn.

The Stag beetles with antler-like jaws belong to this family. The California species are less conspicuous. Their food habits are as follows:—

Fir Ceruchus, Diphyllostoma. Redwood Diphyllostoma. Oak Platycerus. agassii, californicus latus and opacus. Poplar Platycerus depressus. Alder Sinodesdron, Platucerus oregonensis.

Ceruchus punctatus Lec. striatus Say. Diphyllostoma fibriata Fall. striatus Lec.

Platycerus agassii. Lec. californicus Cas. chalybæus-oregonensis.

cœrulescens-oregonensis.

depressus Lec. latus Fall. opacus Fall. pacificus—agassii Lec. parvicollis-agassii. thoracicus Cas. Phyllostoma fimbriata Fall. Sinodendron rugosum Man.

CURCULIONINA

The members of this superfamily are known as weevils.. They all feed on plants and many of them are injurious.

ANTHRIBIDÆ.

Anthribus albinus Linn. Brachytarsus alternatus Say. scabrosus Fabr.

Gonops fissungnis Lec. Toxotropis approximatus Lec.

IPIDÆ.

The members of this family are the wood borers that make the "pin holes" in the bark of trees and the centipede-like burrows under the bark. are sometimes very injurious. They have the following food habits:-

Pine Dendroctonus brevicomis, jeffreyi, monticolæ, volens, Pityophthorus nitidus. Fir Dendroctonus pseudotsugæ. Spruce Scolytos unispinosus. dar Phlæosinus cristatus. Cypress Phlæosinus cupressi. Redwood Phlæosinus sequoiæ. Oak Pityophthorus pubipennis

Bostrichus pini-Tomicus. Carphoborus bifurcus Esch. simplex Lec. Chætophlœus hystrix Lec.

Corthylus cavus-Cryphalus. dentiger-Monarthrum. scutellaris-Monarthrum.

Cryphalus atratulus Lec. carinulatus-Pityophthorus. cavus Lec. dentiger—Monarthrum. digestus—Pityophthorus. pilosulus-Pityophthorus. pubipennis-Pityophthorus. nuncticollis-Pityophthorus. retusus-Pityophthorus. striatus-Hypothenemus.

sulcatus Lec. terminalis Man. Dendroctonus barberi Hop. brevicomis Lec.

brevicornis-barberi. convexifron Hop. frontalis-barberi. frontalis-brevicornis. jeffreyi Hop. monticolæ Hop. pseudotsugæ Hop. similis-monticolæ. simplex-pseudotsugæ. terebrans-valiens. valens Lec.

Gnathotrichus retusus (Lec.) Hylastes gracilins Lec. macer Lec.

nigrinus (Man.) porosus Lec.

lugipennis-Hylurgops. subcostulatus-Hylurgops. Hylesinus aspericollis Lec.

crenatus—sericeus. cristatus—Phlæosinus.

hystrix-Chætophlocus. imperialis Lec. nebulosus Lec. sericeus Man. Hylurgops granulatus Lec. rugipennis (Man.) subcostulatus (Man.) Hylurgus nigrinus-Hylastes. Hypothenemus striatus (Lec.) Ips cacographus (Germ.) confusus Lec. latidens Leec. pini Say. plastographus Lec. pubipennis Lec. sexdentatus Esch. Micracis hirtella Lec. Monarthrum dentigerum (Lec.) huttoni Woll. scutellare (Lec.) Phloeosinus cristatus (Lec.) cupressi Hop. sequoiæ Hop.

Pityophthorus carinulatus (Lec.)

cribripennis Esch. digestus (Lec.) nitidulus Man. pilosus Lec. pubipennis Lec. puncticollis (Lec.) retusus Lec. striatus Lec. sulcatus Lec. Scolytus californicus Lec. destructor—unispinosus. præceps Lec . subscaber Lec. terebrans—Chætophlœus Hystrix. unispinosus Lec. ventralis Lec. Tomicus cacographus-lps. Xyleborus cælatu Esch. Xyloterus bivittatus Kirby. hamatus-Pityophthorus carinulatu. vittiger Esch.

confinus Lec.

CALANDRIDÆ.

The following food habits are known:-

Pine Cossonus pisiphilus, crenotus, Rhyncolus oregonensis. Buckeye Rhynlolus angularis. Yucca Macrorhynchus, Scyphophorus, Yuccaborus. Cactus Cactophagus. Lupine Rhyncolus pallens. Poplar and Maple Cossonus subarcuatus. Drift wood Flassoptes...

Calandra granaria linn. oryzæ Linn. Cossonus californicus—piniphilus crenatus Horn. piniphilus Sch. subareatus Boh. Dryophthorus bitubercu.atus Fabr. corticalis (not California).

Cactophagus validus Lec.

Flassoptes marinus Horn. Lymnantes scrobicollis Gyll. Macrorhynchus protractus Horn. Mesitus tardii Wall. Metamaseus sericeus Horn. Metopotoma repens Phlocophagus minor Horn. Rhina frontalis-Yuccaborus. Rhyncholus angularis Lec.

> brunneus Man. californicus Wol. cylindricollis Wol. dilatatus Ca. dorsalis Lec.

oregonensis Horn. pallens Cas. protensis Wol. spretus Cas.

1.hynchophorus asperulus (not Calif.) palmarum (not California). Scyphophorus acupunctatus Gyll.

robustior (not California). yuccæ Horn.

Sitophylus oryzæ-Calandra. Sphenophorus abrasus Chit. discolor Man.

> gentilis Lec. monterensis-vomerinus. pertinax Oliv.

pictus Lec. procerus-Cactophagus validus.

reticulaticollis Boh. robustus (not California). simplex Lec.

subopacus Chit. sayi Gyll.

subcarinatus Man.

tardus Fall. vomerinus Lec. Yuccaborus frontalis Lec.

CURCULIONIDÆ.

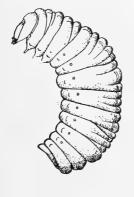
Only a comparative small number or the species of this family of weevils have known food habits.

Pine Magdalus cuneiformis, lecontei, Pissodes radiatæ, yosemite. Willow Orchestes rufipes, salacis. Lupine Apion proclive, Tychius lineellus.

Acanthoscellis californicus Dietz. frontalis Dietz. perplexus Dietz. Alophu constrictus Lec. didymus Lec.

Apion abdominale Sm. antennatum Sm. atripes (not California.)

oblitum (not California). bosoletum (not California). occidentale Fall. ædorhynchum Lec. opacicolle Sm. ovale-obsoletum. pennsylvanicum Boh. porosicolle Gem.



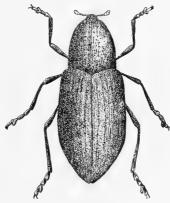


Figure 191 Alfalfa weevil.

brevicolle-cribricolle. californicum-sordidum. clavinatum Sm. cavifrons Lec. chuparosæ (Lower California). concoloratum-carinatum. confertum (not California). cordatum Sm. crassinasum Lec. cribricolle Lec. elutipes (Lower California). floridanum (not California). fraternum Sm. funereum Fall. griseum (not California). hesperidum Fall. minor Sm.

proclive Lec. proclive Lec. protensum Lec. sordidum Sm. troglodytes Man. turbulentum Sm. typicum-ventricosum. varicorne Sm. ventricosum Lec. vespertinum Cas. vicinum-walshii. walshii Sm. Anthonomus æneolus Dietz. affinis Lec. albopilosus Dietz. ater Lec.

brunneipennis Man. canus Lec. confusus Lec. effetus Dietz. figuratus Dietz. hirtus Lec. inermis Boh. melancholicus Dietz. morulus Lec. ochreopilosus Dietfi. ornatus Dietz. pauperculus Lec. peninsularis Dietz. pervilis Dietz. densa-Onychobaris. macra Lec.

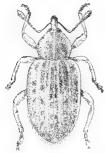


Figure 192. Cotton boll weevil.

seriata—Onychobaris.
Centrocleonus pilosus Lec.
Ceutorhynchus adspersulus Dietz.
albopillosus Dietz.
angulatus Lec.
convexicollis Lec.
cyanipennis Germ.
decipiens Lec.
disturbatus Dietz.
equamosus Lec.
solani Fall
subvittatus Lec.
sycophanta Walsh.
Alyca ephippiator—Elleschus.

Analcis morbillosus—Tyloderma.
Aulobaris naso Lec.
Bagous californicus Lec.
Balaninus uniformis Lec.
Baridius californicus Boh.
Barilepton falciger
quadricolle Lec.

Barinu dificilis
Baris brunneipes
densus—Onychobaris.
mucoreus—Trichobaris.
nasutus—Centrinus.
macra—Baris.
seriatu —Onychobaris.
Barytychius discoideus
quadricolle Lec.
hornii Dietz.
isolatu Dietz.
mutabilis Dietz.
nodipennis Dietz.
obliquus Lec.
ovipennis Dietz.

pollinosus Dietz.

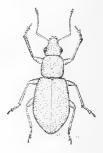


Figure 193. Fuller's rose weevil.

puberulus Lec. pusillus Lec. pusio Man. sericans Lec. subpubescens Lec. testorum Fall. Centrinogyna procera Centrinus confusus Say. lineellus Lec. nasutus Lec. Chelonychus longipes Dietz. Cionistes insolens Dietz. Cleonus ervsimi inornatus Lec. molitor Lec. virgatu Lec. vittatus Kirby. Cœlogaster zimmermani Gyll. Conotrachelu duplex dehiscens Fall. koebelei-adspersus.

littoralis Fall. pleuralis Lec. longatus Lec. lunaus Lec. mamillatus Lec. mediinotus Fall. mucidus—nubilatus. princeps Fall. Copturus adspersus Lec. Elleschus ephippiatus Say. Epimechus mobilis Fall. Emphyastes fucicola Man. Endalus æratus Lec. limatulus Gyll. ovalis Lec. Epimechus æmulu adspersus Dietz. mimicus Dietz. nevadicus Dietz. soriculus Dietz. Euclyptus ferrugineus Lec. Hypera montivaga Camp. serrana Camp. Lepidosoma californicum Mots. dehiscens Fall. koebelei-adspersus. littoralis Fall. mediiventrus Fall. Cryptohypnus colon Horn. funebris Chaud. futilis Lec. mops Lec. ornatus Lec. pectoralis Say. squalidus Lec. Cryptorhynchus gracilis Boh. Desmoris constrictus Say. fulvus Lec. incertus Dietz. sordidus Lec. Dinocleus albovestitu hystrix Fall. Dory fomus cuneatulus hirtus Lec. luridus Man. mucidus Say. Leprus perforatus Limnobarins confusus Say. Listronotus gracilis Lec. teretirostris Lec. Lixus asperus Lec. acutus Lec. maritimus Fall. modestus Man. parcus Lec. perforatus Lec. perlongus Fall.

poricollis Man. Mac. cphoptus estriatus Lec. hispidus Dietz. Macrops californicus Dietz. hyperodes Dietz Magdalinops vittipennis Dietz. Magdalus alutacea Lec. adenescens Lec. convexicollis Fall. gentilis Lec. gracilis Lec. hispoidec Lec. hyperodes Dietz, imbellis Lec. lecontei Horn. proxima Fall. striata Fall. subtincta Lec. vitiosa Fall. Macromastus gracilis Boh. Onychobaris densa (Lec.) seriata (Lec.) Orchestes albionica Lec. ephippiatus Say. lapidula Lec. mitus Horn. parvicollis Lec. puberulus Boh. ramosa Cr. rufipes Lec. salicis Linn. Orthoris crotchii Lec. Otidocephalis vittatus Horn. Pachyphanes carus Dietz. Pachytychius discoideus Lec. corpulentus Lec. Paragoges maculatus Lec. Pelenemus cavifrons Lec. Phycocœtes testaceus Lec. Phyllotrox nubifer Lec. Piazurus californicus Lec. Pissodes barbari Hop. californicus Hop. costatus Man. radiata: Hop yosemite Hop. Plinthus carinatus Boh. Podapion gallicola Ril. Promecotarsus maritimus Cas. Pseudoparis nigrina Physsematus qubescens Pycnobaris nigrostriatus Fall. Rhinonchus longulus Lec. Sibynes fulvus Sitones alternans

californicus Fah. crinitus Oliv. semiculus Man. sordidus Lec. vittatus Lec. Smicronyx californicus Dietz. cinereus Mots. instabilis Ca. nubilus Dietz. obtectus Lec. ornatipennis Dietz perplexus Dietz. pusillus Dietz. pusio Lec. resplendens Dietz. scalator Dietz.

tardus Dietz. Stenopelmus rufinasus Synertha imbricata Ca. Tachyperus quadrigibbosus Say. Trachotes ptinoides Germ. Trichobarins compacta Trichomagdalus atratus Fa... conspersus Fall. fasciatus Fall. micorea Lec. Triglyphus ater Lec. Tychinus lineellus Lec. semisquamosus Lec. setosus Lec. setosu Lec. Tyloderma morbillosum Lec. Zascellis irrorata Lec.

OTIORHYNCHIDÆ.

The Otiorhynchid weevils feed largely on trees. The food of the following are known:—

Pine Geoderces puncticollis. Geodercodes, Scythropus albidus, californicus, elegans. Fir. Dyslobus. Spruce Scythropus ferrugineus. Willow Stamoderes Oak Adolares.

Adalares humeralis Cas. adalares humeralis Cas. ovipennis Cas. Agasphærops nigra Lec. Agronus cinerorius Horn. deciduus Horn. Amnesia decidua Horn.

serriatus Lec.

decorata Lec.
discors—sculptilis.
elongate Horn.
granulata Cas.
rauca Horn.
sculptilis Cas.
sordida Horn.
squamipunctata—Sculptilis.
tessellata Cas.
tumida—sculptilis.
longipennis Pier.

longisternus Cas.
Amotus setulosus Lec.
Aragnomus griseus Horn.
Aramigus fulleri Horn.
hispidulus Cas.

Dirognathus sordidus Horn.

Dyslobus segnis (Lec.)

Dysticheus insignis Horn.

Elissa constricta Cas.

Encyllus vagans Horn.

Eupagoderes argentatus (Lec.)

aridus Fall.

desertus Lec. germinatus Lec. mortivallis Fall. plumbeus—varius.

varius (Lec.) (Geoderces incomptus (Lec.) puncticollis Cas.

Geodercodes latipennis Cas.
Miltoderes setosus Cas.

setulosus—Amotus.
Mimetes seniculus Horn.
Minyomerus languidus Lec.
Mylacus saccatus Lec.
Nocheles vestitus Cas.
Nomidius abruptus Cas.

Ophryastes argentatus—Eupagoderes. varius Eupagoderes.

Orimodema protracta Horn.
Orthoptochus squamiger Cas.
Otiorhynchus rugifrons Gyli.
segnis—Dyslobus.

Panormus setosus Cas.
Paraptochus californicus—sellatus.
Periteles sellatus—Peraptochus.
Peritelopsis globiventris Lec.
Peritelodes obtectus Cas.
Phymatinus gemmatus Lec.
Rhigopsis effracta Lec.

scutellaris—effracta. Peritelinus variegatus Cas. Rhypodes dilatatus Horn. Sciopithes angustalis-obscurus.

brumalis—obscurus. arcuatus—obscurus. obscurus Horn. setosus Cas.

significans-obscurus.

Scythropus albidus Fall. californicus Horn. cinereus Cas. elegans Coup.

ferrugineus Cas. lateralis Cas. miscix Fall. Stamoderes uniformis Cas. Stenoptochus inconstans Cas. Strophosomus alticola-Aramigus ful-

Thinoxenus squallens Horn. Thricolepis inornata Horn. Trogonoscuta pilosa Mots. simulator Horn.

RHYNCHITIDÆ.

The genus Deporaus is found on oak, Rhynchites aureus on manzanita and R. bicolor feeds on rose and thimble berry.

Auletes laticollis Cas.

nasalis Lec. rugipennis Pier. viridis Pier.

Deporaus glastinus (Lec.) Rhynchites æratoides Fall. aureus Lec. bicolor Fabr. glastinus-Deporaus. nasio Cas. planifrons Lec. velatus Lec.

RHINOMACERIDÆ.

The weevils of this family are found on pine flowers Diodyrhynchus byturoides Lec. Rhinomacer bombiformis Lec.

comptus Lec. pilosus Lec.

CHRYSOMĖLINA

LARIIDÆ.

The snout-like prolongation of the head in this family causes them to be called weevils the belonging to a different superfamily.

Pea Laria pisorum. Bean Acanthoscelides. Broad bean Laria rufimana.

Mesquite Laria prosopis. Bruchus aureolus Horn.

aria Fall. californicus Boh. collosus Fall. desertorum Lec. discopterus Fall. exiguus Horn. fraterculus Horn. gibbithorax Sch. griseolus Fall. impiger Horn. inquisitus Fall. laria Fall. limbatus Horn. obsoletus Say.

obtecus-obsoletus. pauperculus Lec. perplexus Fall. pisorum Linn. pullus Fall. prosopis Lec. protractus Horn. pruinius Horn. ramicornis Boh. seminulum Horn. sordidus Horn. texanus Sch. uniformis Lec. Zabrotes densus Horn.

spectabilis Horn.

CHRYSOMELIDÆ.

The plant beetles of the family Chrysomelidæ are in some cases general feeders the in most cases they are associated with a particular plant. The following list includes most of the commoner species:—

Coniferæ Luperoides smaragdinus. Pine Glyptoscellis illustris, pubescens. Fir Syneta carinata Cedar Glyptoscellis pubescens, Willow Crepidodera helxines, Diachus, Disonycha 5-vittata, Galerica flavolimbata, Glyptoscellus albidus, Pla-

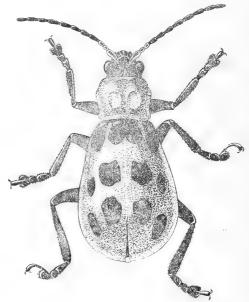


Figure 194. Diabrotica soror.

umbine Cassida bicolor. Sidalcea Calligrapha sigmoidea. Marsh marigold Calgiodera, Syneta albida, Zeugophora californica. Poplar Syneta albida Zeugophora. Alder Haltica bimarginata. Buckeye Luperodes bivittatus. Oak Syneta simplex. Ceanothus Luperodes torquatus, varipes Odontota californica. Orsodachna atra. Manzanita Colaspidea varicolor, Colaspis oregonensis Grape Adoxus, Haltica carinata. Raspberry Paria canella. Cucumber Coptocycla bicolor, Diabrotica trivittata. Solanum Cassida pallidula. Datura Lema.. Colligrapha elegans. Corn andbeets Chætocnema denticulata. Milkweed Chrysochus. Goldenrod Trirhabda flavimarginata. Eriogonum Saxinus saucia. Eriodactylon Trirhabda caduca, eriodactylonis. Grass Disonycha pennsylvanica Sedge Donacia.

SYNOPSIS OF GENERA.

Haltica: hind femora enlarged and with transverse impression on base of

prothorax not limited on the side by a longitudinal plica.

Chætocnemis: Hind femora enlarged and hind tibiæ toothed on outer margin. Euplectroscelis: size large, 5.5 mm.

Phyllotreta: hind femora enlarged. Crepitodera and Systema: front coxal cavities closed, the last with elytra not striate. Psilloides: antennæ ten-



Figure 195. Work of Diabrotica soror.

jointed. Œdionychis: last joint of hind foot globose. Diabolia: apical spur of hind tibiæ large. Glyptina: elytra striato-punctate. Longitarsis: first joint of hind tarsi half as long as tibiæ. Apthona: groove on hind tibiæ bifurcate.

Pachybrachus: middle ventral segments narrowed. Exema: antennæ received in marginal grooves. Euryscopa, Coscinoptera, Babia and Saxinis: front coxal cavities confluent, the first two with claws simple, the elytra of the

first with rows of punctures, and the epipluræ of the last narrow. Diacus: claws simple. Cryptocephalus: prothorax margined.

Trirhabda: antennæ on front between the eyes and claws simple, cleft or acutely toothed. Diabrotica: front carinate. Galeruca and Monoxia: epipleuræ extending to sutural angle, the last with front narrow.

Luperodes: antennæ on front between the eyes. Phyllobrotica: elytra without epipleuræ. Androlyperus: last joint of maxillary palpi not conical. Scelolyperus: epipleuræ narrow.

Criocerus: prothorax not margined. Xanthonia and Adoxus: front coxæ distinctly separated, the first with prosternal sutures obsolete. Donacia:



Figure 196. Work of Adoxus obscurus.

first ventral segment very long. Zeugophora: eyes emarginate. Syneta: prothorax toothed at the sides. Tricolema: prothorax subangulate at sides. Crscdachna: prothorax somewhat bell-shaped. Lema: prothorax constricted at middle.

Glyptoscelis: front not inflexed. Metachroma, Colaspidia and Colaspis: anterior margin of prothorax straight beneath, the last without supraorbital lines on head, the first with body glabrous. Paria and Chrysochus: body glabrous, the first with hind tibiæ toothed towards the tip. Myochrous: sides of prothorax toothed.

Cassida. Microrhopala, Odontata and Stenopodius: head free, the last with third joint of tarsi narrow, the first with antennæ apparently nine-jointed. Coptocycla: antennæ extending beyond base of protherax.

Adoxus obscurus Linn.
vitis—obscurus.
Androlyperus fulvus Cr.
maculatus Lec.
Aphthoma subglobosa Mots.
Aulacoscelis purpurea
Babia quadriguttata Oliv.
tetraspilota Lec.
Balophila cerina—Glyptina.
Calligrapha californica—elegans.
elegans Oliv.
serpentina Rog.

rugulosa—Exema conspersa.
Chrysochus californicus—cobaltinus.
cobaltinus Lec.
tenebricosus—cobaltinus.
Chrysomela cæsia—Gastroidea cyanea.
californica—Lina.
Colaspis cuprascens (Lec.)
smaragdula (Lec.)
subvittata (undetermined).
varicolor (Cr.)

Colaspis californica Boh.



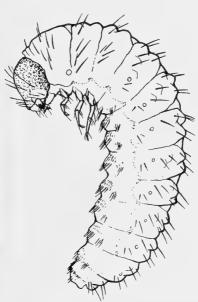


Figure 197. Larva of Adoxus obscurus.

Cassida aurisplendens Man.
9-maculata Man.
nigripes Oliv.
pallidula Boh.
texana—pallidula.
Chætocnema confinis Cr.
cribrata Lec.
cribrifrons Lec.
denticulata III.
ectypa Horn.
irregularis Lec
opacula Lec.
sigmoidea Lec.
Chlamys conspersa—Exema.

cpulenta Horn
subcylindrica Lec.
subviridis Lec.
oregonensis Cr.
Coptocycla aurichalcea—bicolor.
bicolor Boh.
cucumeris—Epitrix.
helxines Linn.
pallida Fall.
puberula Boh.
sulphurella Boh.
subcarinata—Epitrix.
bicolor Fabr.
Coscinoptera œneipennis Lec.

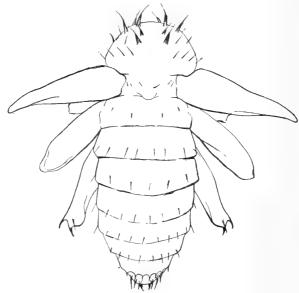


Figure 198 Pupa of Adoxus obscurus. (upper side).

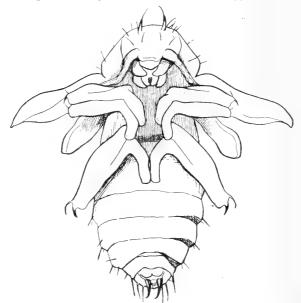


Figure 199. Pupa of Adoxus obscurus (lower side).

biferia-canella. canella Lec. mucorea Lec. Crepidodera basalis Cr. vafra Boh. Criocerus asparagi Linn. castaneus Lec. chalconotus Man. limbifer Sid. nigerrimus San. sanguinicollis—lus trans. Epitrix bicolor spurcatus Lec. Cryptocephalus auratus Lec. Diabolia ærea Mels.

pennsylvanica III. puncticollis-Monoxia. 5-vittata Say.
Donacia atra—Orosdachna. californica Lec. cincticornis Newm. emarginata Kirby. hirticollis Kirby. piscatrix Lec. proxima-cincticornic. pusilla Say. subtilis Kun.

cucumeris Horn.

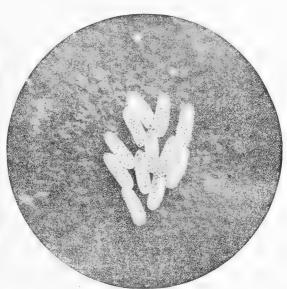


Figure 200 Eggs of Adoxus obscurus.

borealis Chev. ovata Lec. Diachus auratus Fabr. erasus Lec. Diabrotica 12 punctata Fabr. soror Lec. tenella—12-punctata. trivitta Man. viridipennis Lec. Disonycha alternata III.

limbicollis—pennsylvanica. maritima Man.

parvula Fabr. subcrinita Lec. Eumolpus cuprascens—Colaspidea smaragdulus-Colaspidea. Euplectrocelis xanti Cr. Euryscopa lecontei Cr. scapularis-lecontei. subtilis Horn. vittata Lec. vittata (not Canlfornia). Exema conspersa Man. ycha alternata III. Galeruca angularis—Monoxia guttulata externa Say. consputa-Monoxia.

flavolimbata—Trirhabda.
luteocincta—Trirhabda.
morosa—Monoxia.
sordida—Monoxia.
tuberculata—Gallerucella.
Galerucella notulata Fabr.
marginella Kirby.
tuberculata Say.

varicolor—Colaspidea.
Gonioctena pallida Linn.
Haltica ærugincsa Lec.
albionica Lec.
areola Lec.
bimarginata Say.
californica Man.
carinata Germ.

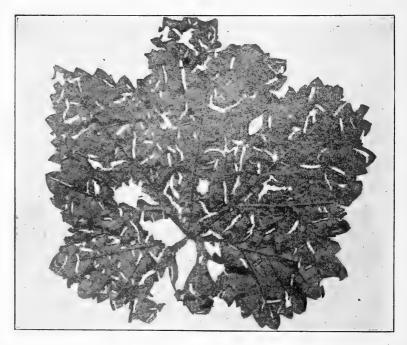


Figure 201. Work of Adoxus obscurus.

Galeruca tuberculata Say.
Gastroidea cæsia—cyanea.
dissimilis Say.
cyanea (Rog.)
Glyptina atriventris Horn.
ceria Lec.
Glyptoscellis albidus Lec.
alternatus Cr.
cuprascens—Colaspidea.
illustris Cr.
smaragdulus—Colaspidea.
pubescens Fabr.
squamulatus Cr.

cerina Lec.
convicta Fall.
gracilis Robe.
lazulina Lec.
lepidula Lec.
ligata Lec.
limbicollis Lec.
maratima Lec.
mitis Lec.
oblonga Lec.
ochracea Lec.
opulenta Lec.
plicipennis Lec.

probata Fall. Monoxia angularis Lec. prasina Lec. consputa Lec. punctipennis Lec. debilis Lec. pura Lec. guttulata Lec. recticollis Lec. puncticollis Say. seminulum Lec. sordida Lec. subglobosa Lec. Myochrous angulus Lec. suborinita Lec. Myocoryna 11-lineata Cr. Myoctrous longulus Lec. subænia Lec. suspecta Fall. Odontata californica Horn. tegularis Robe. hardyi Cr. rubra Web. tincta Lec. tombacina Man. Œdionychus fimbriata Forst. torquata Lec. Iongula Har. violascens Lec. verticalis Robe. Orchestris ramosa-Phyllotreta. Henniglyptus basalis Cr. Lema nigrovittata Guer. Orsodachna atra (Ahr.) Leptothrix recticollis Lec. Orthallica recticornis-Leptothrix. 11-linetat Pachnephorus smaragdulus-Glypto-Lina californicus-Melasoma. scellis. lapponica-Melasoma. pidea. Longitarsis californicus Mots. Pachybrachys analis Lec. livens Lec. circumcinctus Cr. mancus Lec. cœlatus Lec. montigagus Horn. donneri Cr. repandus Lec. hybridus Sch. rufescens Horn. livens Lec. Luperodes bivittatus Lec. lustrans Lec. curvatus Fall. melanostictus Sch. crassicornis Fall. signatifrons Man. laticeps Horn. viduatus Fabr. morrisoni Jac. Paria canella Fabr. smaragdinups Lec. 6-notatus Say. torquatus Lec. Phædon oviformis Lec. transitus Horn. Phyllobrotica flavicollis-Scelolyperus. varipes Lec. Iuperina Lec. Luperus abdomnialis nigripes Horn. bivittatus-Luperodes. viridipennis Lec. flavicornis-Scelolyperus. Phyllotreta albionica Lec. graptoderoides-Scelolyperus. denticornis Horn. longulus-Scelolyperus. lepidula Lec. maculicollis—Scelolyperus. smaragdinus—Luperodes. lewisii Cr. oregonensis Cr. thoracicus Boh. pusilla Horn. torquatus-Luperodes. ramosa Cr. Malachorhinus maculatus Lec. vittata Fabr. Mantura floridana Cr. Plagiodera lapponica Linn. Megalostomus mucorea-Coscinoptera. Psylloides convexior Lec. Megistops quadrinotata Boh. interstitialis Lec. Melasoma californica Rog. parvicollis Lec. Metachroma californica Cr. punctatula Mels. peninsularis (Lower California). Saxinus bisignata—saucia. Metacycla insolita Lec. politula Horn. Microrhapala melsheimeri Cr. saucia Lec. rubroliniata Man. speculifera Horn. signaticollis Lec. Scelolyperus decipiens Horn.

flavicollis (Lec.) graptoderoides (Cr.) Iongulus (Lec.) loripes Horn. maculicollis (Lec.) schwartzii Horn. tejonicus Cr. Stenopodius flavidus Horn. Syneocephalus autumnalis Fall. Syneta albida Lec. carinatus Man. serinata—albida. simplex Lec. suturalis-albida. Systena ligatus—tæniata. mitis-tæniata. ochracea-tæniata. pallidula Boh. subænea Lec.

tæniata Say.

Teinodactyla californica Mots. Thricolema anomala Cr. Trimarcha intricata Hald. Trachycelida bicolor Lec. Trirhabda attenuata Say. caduca Horn. canadensis Kirby. eriodictyonis Fall. diducta Horn. flavomarginata Man. germinata Horn. labrata Fall. luteocincta-flavomarginata. tomentosa Linn. Typophorus oregonensis—Colaspis. vividicyaneus Cr. Xanthonia villosula Mels. Zeugophora abnormis Lec. californica Cr.

CERAMBYCIDÆ.

The members of this family are known as long horned wood borers. Most of the species confine themselves to the wood of a single kind of tree. The following food habits are known:—

Conjferæ Anthophilax. Pine Acanthocinus, Asemum, Callidum hirtellum, Haplidus, Leptura brevicornis, grossa, insignis, valida, Monohammus maculosus, titillator, Pogonocherus califorincus, Rhagium Tragosonia, Ulochætes. Fir Callidium, Clytus, Criocephalus Hylotrupes litigiosus Leptura obliterata, propingua, Monohammus scutellatus, Pachyta liturata, monticola, Phymatodes varius, Pogonocherus oregonus, Tetriopium, Tragosonia, Xylotrechus undulatus. Spruce Hylotrupes ligneus, Leptura carbonata, nigrella, propinqua, sexmaculata, Neoclytus muricatus, Opsimus, Pachyta spurca, Phymatodes des. Redwood Leptura impura, matthewsii, Phymatodes nitidus. Willow Leptalia, lpochus, Saperda hornii, Xylotrechus insignis, obliteratus. Poplar æneus, variabilis. Cedar Atimia, Hylotrupes, Leptura matthewsii, Phymato-Hyperplatys, Ipochus, Saperda populnea, Synaphæta, Xylotrechus annosus. Oak Elaphidion, Ipochus, Phymatodes decussatus, obscurus, Pogonocherus crinitus, Prionus. Walnut Phymatodes juglandis, Synaphæta. Laurel Leptura crassipes, Holopleura. Eucalyptus Leptura crassipes, Necydalus. Manzanita and Madrone Neoclytus conjunctus. Ceanothus Ipochus. Alder Pyrotrichus. Mesquite Tragidion annulatum. Yucca Tragidion armatus, Cactus Conopous, Monilema. Blueberry Desmocerus californicus. Redberry Desmocerus cribripennis. Mt. Elder Desmocerus auripennis. Apple Hyperplatys, Milkweed Tetraopes.

SYNOPSIS OF GENERA.

Leptura: front coxæ conical, eyes not enveloping base of antennæ, front

oblique or horizontal first joint of hind tarsi without brush. Desmocerus and Necydalus: mandibles not fringed, the latter with elytra very short. Strangalia: last ventral segment of male deeply excavated

Phymatodes: front coxæ transverse, prothorax not margined. Asemum, Tetropium, Opsimus and Dicentrus: ligula horny, the last two with prothorax emarginate, the second with four eyes, the third with femora clavate. Xylocrinus: mesonotum punctured and pubescent. Callidium: mesonotum polished with scattered punctures. Hylotrupes: prosternum broad.

Acmæops: front coxæ conical, eyes not enveloping base of antennæ, front oblique or horizontal. Rhagium: prosternum prominent between the coxæ. Centrodera: eyes coarsely granulated. Toxotus: tibial spurs not terminal. Pachyta and Anthophylax: prothorax acutely armed on sides, the latter strongly emarginate.

Crossidius: scutellum acutely triangular. Stenosphenus: front coxalcavities open. Dendrobius, Tragidion, Metaleptus, Purpuricenus, Ammanus and Batyle: mandibles not emarginate at tip, the first with prosternum broadly lobed at base,, the last two with front short, the third with pubescence concolorous with punctures, the fourth with body glabrous and the last with body pilose. Ischnocnemis: with ivory vittæ. Oxoplus: prothorax with acute lateral spine.

Xylotrechus: tlbial spurs large. Cyllene and Calloides: intercoxal process rounded, the first with pronotum transversely excavated at sides. Neoclytus: front quadrate. Clytus. head not carinate.

Monilema: front tibiæ sulcate on inner side, humeral angles not prominent. lpochus: body densely pilose.

Pogonocherus: front tibiæ sulcate on inner side, front coxæ not protuberant. Monohammus and Synaphæta: scape of antennæ with apical scar, the former with body elongate. Acanthoderes, Cænopocus, Hyperplatys and Acanthocinus: front coxæ rounded, the first with scape of antennæ clavate, the second with lateral tubercle of thorax at middle, the third with a long ovipositor. Lipsimena: middle tibiæ without external sinus.

Tetraopes: last joint of palpi cylindrical and pointed. Idomea and Methia: elytra abbreviated,, the antennæ of the latter apparently ten-jointed. Saperda: all claws simple. Oberea: with two eyes.

Elaphidion: prothorax not margined. Atimia: stridulating plate divided. Poscilobrium, Hybodera, Callimus, Megobrium, Molorchus and Callimoxys: front coxal cavities closed behind, the first four with first abdominal segment very long, the first with palpi broadly triangular, the second with punctures fine, the third with mesosternum wide, the last with hind tibiæ curved inwards. Malachopterus, Ceme, Eucrossus and Haplidus: ligula horny, the last with palpi slender, the first two with prosternum laminiform, the first with prothorax lobed at base. Bothrylus: front coxal cavities angulated. Aneflus: antennæ carinate. Romalium: metaepisternum narrower behind.

Prionus. Ergates and Mallodon: prothorax pleuridentate, the first with

vile Lec

third antennal joint very long. Tragosoma: metaepimera narrowed behind Derobrachus: antennæ filiform. Acanthocinus obliquus Lec. vulneratum-Phymatodes. spectabilis Lec. Callimoxys fuscipennis Oliv. Acanthoderes peninsularis (L.Calif.) sanguinicollis-fuscipennis. Acmæops basalis Lec. Callimus cyanipennis (Lec.) falsa Lec. chalybæus—Pœcilobrium. longicollis—ruficollis. fuscus-tumida. opacipennis-ruficollis. lisa-Leptura gnathodes. varipes-ruficollis. longicornis Kirby. dehiscens-ruficollis. lugens-tumida. marginalis Lec. ruficollis (Lec.) militaris Lec. Calloides lorquini Bug. pinguis Lec. Compasa quadriplagiata (not Calif.) puncticollis (not California). pratensis Laich. proteus Kirby. Centrodera nevadica Lec. subæneus Lec. Clytus conjunctus-Neoclytus. lanifer Lec. subcyanea-tumida. lorquini-callicdes. subpillosa Lec. tumida Lec. planifrons Lec. variepes Cas. nauticus-Xylotrechus. vincta Lec. Cœnopœus palmeri Lec. viola Lec. niger (Lower California). Ædilis obliquus—Acanthocinus. Criocephalus asperatus Lec. Amannus pectoralis Lec. productus Lec. Aneflomorpha longipennis-Elaphidion. Crossidius ater Lec. Anaflux linearis Lec. discoideus Say. prolixus (Lower California.) hirtipes Lec. protensis (Lower California). . . intermedius Ulke Anocomus ampla-Hylotrupes ligneus. maculicollis-testaceus. Anthoprilax tenebrosus Lec. pulchellus Lec. Asemum atrum Esch. punctatus Lec. nitidum Lec. testaceus Lec. Atimia confusa Say. Cyllene antennatus White. dorsalis Lec. crinicornis Chev. Atimia confusa (not California). · Ceruchus punctatus Lec. Batyle suturalis Say. Dendrohius mandibularis Serv. Brothylus conspersus Lec. reductus-mandibularis. gemulatus Lec. Derobrachus germinatus Lec. Callichroma ceneum-Callidium. Dysphaga debilis (Lower California). agassii-Xylocrius. Desmara in aurinennis Chev. amethestinus-Hylotrupes. californicus Horn. blandum-Phymatodes. cribripennis Horn. Callidium antennatum Newm. Dicentrus bluthneri Lec. decussatum-Phymatodes. sexnotata-bluthneri. hirtellum Lec. Euburia ulkei (Lower California). .. infuscatum-Phymatodes. Elaphidion albafasciatum Lin. ianthinum Lec. imbelle Lec. hesperum-antennatum. punctatum Lec. salffornicum-antennatum. Eustroma validum Lec. mannerheimi-Phymatodes dim- Euderces parallelus (not California). idiatum. Eucressus villicornis Lec. obscurum—Phymatodes. Eudistenia costipennis Fall. varium-Phymatodes. Eustroma validum Lec.

Eumichthus ædipus Lec.

Ganimus vittatus-Malachopterus. Gaurotes cressoni Bland. Haplidus testaceus Lec. Holopleura helena Lec. marginata-helena. Hybodera debilis-tuberculata. tuberculata Lec. Hylotrupes amethystimus Lec. litigiosus Cas. ligneus Fabr. Hyperplatys aspersus (Say). californicus—aspersus. Idœmea californica Fall. Ipochus fasciatus Lec. pubescens—fasciaus. subnitidus—fasciatus. Ischnocnemis bivittatus Dup. Lamia aspersus—Hyperplatys. Leptalia macelenta Man. Leptostylus palmeri-Conopous. nebulosus Horn. Leptura aspera Lec. barbaræ Fall. behrensii Lec. brevicornis Lec. carbonata Lec. chrysocoma Kirby. coccinea Lec. convexa-instabilis. coquilletti Lin. crassicornis-crassipes. crassipes Lec. cubitalis-Acmæops. dehiscens Lec. dolorosa Lec. fusciventris-crassipes. fuscicollis Lec. gnathoides Lec. grossa Lec. impura Lec. insignis Fall. instabilis Hald. kerniana Fall. læta Lec. lætifica Lec. lugens Lec. matthewsii Lec. molybdica Lec. nigrella Say. obliterata Hald. pernigra Lin. plagifera Lec. propinqua Bland

quadrulum Lec.

rhodopus Lec.

ruficeps-subargentata. rubida Lec. ruficollis (not California). sanguinea Lec. scripta Lec. sexmaculata Linn. sexspilota Lec. soror Lec. sphæricollis (not California). subargentata Kirby. subcostata Fall. tribalteata Lec. valida Lec. vexatris Man. vitiosa-obliterata. xanthogaster—crassipes. Lisemum mokelumne-Asemum nitidum. Lianema tenuicornis (Lower Calif.) Lilonotus multifasciatus Dup. Lypsimena californica Horn. Malachopterus lineatus Guer. vittatus-lineatus. Mallodon mandibularis Gem. melanopus Linn. Malthopia oculata—Aneflus linearis. Mathopia oculata—Aneflus linearis. Mecas inornatus Say. Mecotetarsus antennatus Bates. Megobrium edwardsii Lec. Metaleptus angulatus Chev. batesi Horn. Methua æstiva Fall. Monilema semipunctatum (L. Calif.) spoliatum Horn. subrugosum (Lower California.) Molorchus longicollis Lec. Monohaminus maculosus Hald. scutellatus Say. titillator Fabr. Necydalus barbaræ Riv. cavipennis Lec. lævicollis Lec. Neoclytus balteatus Lec. carus Fall. conjunctus Lec. infans-muricatulus. interruptus Lec. irroratus Lec. magnus Sch. modestulus Fall. muricatus Kirby. tenuiscriptus Fall. tularensis-conjunctus. schaumii Lec.

Nothorhina aspera Lec. concolor (undetermined). Oberea quadricallosa-schaumii. violans (Lower California). schaumii Lec. laticollis (not California). tripunctata (not California.) Purpuricenus dimidiatus Lec. Pyrotrichus vitticollis Lec. Œme costata Lec. Ptychodes trilineatus (Lower Calif.) strangulata Horn. Rhagium liniolatum Oliv. gracilis Lec. Omoscylon subrugosum-Monilema. Rhopalophora—rugicollis (L.Calif.) bicincta (Lower California). Ophistomis ventralis Horn. Romalium seminitidum Horn. Opsimus quadrilineatus Man. Oxoplus cruentus Lec. simplicicolle Hald. Rosalia funebris Mots. jocosus Horn. marginatus (Lower California). Saperda hornii Jou. Pachyta falsa-Acmæops. mæsta (not California). liturata Kirby. mutica (not California). monticola Rand. populnea Linn. proteus-Acmæops. Semanotus amethestinus-Hylotrupes. spurcata Lec. ligneus-Hylotrupes. Sphænothecus suturalis Lec. lubænea-Acmæops. Paraclytus brevitarsis—Clytus lanifer. Stenaspis solitaria (Lower California). Stenoptarsis fuscipennis-Callimoxys. lanifer. Perarthus vittatus Lec. Stenosphenus novatus Oliv. Peritapnia nudicornis (Lower Calif.) Strangalis delicata Lec. Phymatodes æneus Lec Styloxus lucanus (Lower California). blandus Lec. Synaphœta guexi Lec. Tetraopes basalis-femoratus. concinnus-vulneratus. crucialis-Clytus lanifer. femoratus Lec. crucialis-nitidus. mancus-femoratus. oregonensis-femoratus. decussatus Lec. dimndiatus Kirby. elegans (Lower California). elegans-nitidus. Tetropium cinnamopterum (not Calif.) exelis-nitidus. velutinus Lec. grandis-obscurus. Toxotus flavilineatus—vestitus. harfordi-decussatus. lateralis-vestitus infuscatus-variabilis. nubifer-vestitus. juglandis Leng. vestitus Hald. nitidus Lec. virgatus Lec. obliquus-decussatus. Tragidion annulatum Lec. obscurus Lec. armatus Lec. variabilis Linn. Tragosonia harrisii Lec. varius Fabr. pilosicornis-harrisii. vulneratus Lec. Ulochætes leoninus Lec. Physocnemum amesthinum—Hylotru-Xylocrius agassizii Lec. cribratus Lec. Phyton discoideum (Lower California). Xylotrechus albonotata-undulata. Pilema cyanipenne-Callimus. annosus Say. Pœcilobrium chalybeum Lec. disruptus-insignis. ruflcolle—Callimus. incongruens-insignis. Pogonocherus californicus Sch. insignis Lec. rugosipenne Lin. longitarsis-undulata. crinitus Lec. nauticus Man. concolor Sch. obliteratus—insignis. mixtus (not California). planifrons-Clytus. oregonus Lec. undulatus Say. Prionus ambricornis-californicus.

SPONDYLIDÆ.

 uniformis Man.

COCCINELLINA

ENDOMYCHIDÆ.

Aphorista læta (Lec.)
limbata—Mycetina.
morosa (Lec.)
Eninocus lætus—Aphorista

Epipocus lætus—Aphorista.

Mycetina endomyctoiues—..mbata.
læta—Aphorista.

limbata Horn.
hornii Cr.
morosa—Aphorista.
Phymatophora californica Horn.
pulchella Newm.
Xenomycetes morrisoni Horn.

COCCINELLIDÆ.

The lady birds feed on plant lice and scale insects.

Adalia bipunctata Linn. humeralis—bipunctata. frigida Sch.

frigida Sch.
Agrabia sicardi Newm.
Anatis rathvoni Lec.
subvittat aMuls.
Anisosticta serrata Mels.
vittigera Lec.

Axion pilatei Muls. plagiatum (Oliv.) pleuralis—Axion pilatei
Cleis minor Cas.
Coccidula lepida (not California).
suturalis—occidentalis.
Coccinella abdominalis—Olla oculata.
barda—trifasciata.
bridwelli Nun.

californica Man.



Figure 202. Axion plagiatum.

pleurale—plagiatum. Brachycantha bliasdelli Nun. Iengi Nun.

pacifica Cas. Brumus æthiops Bland. histrio Fall. septentrionis Weise.

Cephaloscymnus occidentalis Horn. ornatus Horn. zimmermani (not California).

Chilochorus bivulnerus Muls. cacti Linn. confusor—bivulnerus. fraternus—bivulnerus. orbus—bivulnerus.



Figure 203. Coccinella californica.

eugenii—trifasciata.
franciscana—9-notata.
humboldtiensis Nun.
impressa—trifasciata.
juliana—trifasciata.
melanopleura Lec.
menetriesi Muls.
monticola Muls.
5-notata—transversoguttata.
prolongata Cr.
transversalis—transversoguttata
transversoguttata Fabr.

trifasciata Linn.
9-notata Herb.
15-notata Kirby.
11-punctata Linn.
Cryptognatha catalinæ Horn.
pusilla Lec.
Cryptolæmus monstrouzieri Muls.

fasciatus Cas.
histrio—Brumus.
marginipennis Lec.
pilatei—Axion.
Harmonia picta Rand.
Hippodamia ambigua Lec.
apicalis Cas.

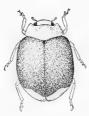


Figure 204. Cryptolæmus montrouzeri.



Figure 205. Hippodamia convergens.



Figure 206. Hippodamia ambigua.

Cycloneda abdominalis—Olla oculata.
catalinæ—Cryptognatha.
oculata—Olla.
polita—sanguinea.
rubripennis—sanguinea.
sanguinea Linn.
Delphastus catalinæ Horn.
sonoricus Cas.
Didion longulum Cas.
parviceps Cas.
Epilachna corrupta Muls.
Eriopis connexa Germ.
Exochromus californicus Cas.
childreni Muls.



spuria Lec. subsimilis-5-signata. 13-punctata Linn. trivittata-sinuata. Hyperaspis angustula Cas. annexa Lec. annulatus Boh. arcuata Lec. cincta Lec. dissoluta Cr. effeta Cas. ellyptica Cas. excelsa Cas. fastidiosa Cas. fidelus Cas. fimbriolata Mels. horni-4-oculata. idæ Nun. 8-notata.



Figure 207. Hyperaspis, 8-notata.

Linedorus lophenthus Rla.
Megilla maculata DeG.
Mæmie episcopalis Kırpy.
Mysia horni—Neomysia.
Neomysia horni Cr.
Nipus bipltagiatns Cas.
niger Cas.
Novius cardinalis Muls.

koebelei Oliv.



Figure 209. Novius koebeli.
Olla abdominalis—oculata.
oculata Fabr.

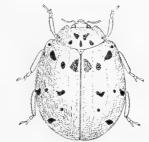


Figure 210. Olla oculata.

Olia plagiata Cas.



Figure 211. Olia plagiata.





Figure 208. Novius cardinalis.



Figure 212. Young Cottony Cushion Scales on orange leaf. Larva and adult of the Australian ladybird, Novius cardinalis, heetle also shown feeding upon the scales.

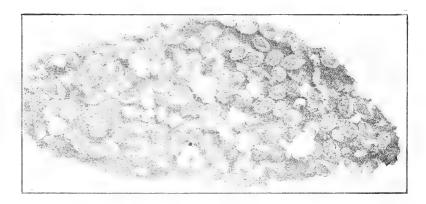


Figure 213. Pupe of Novius cardinalis in orange tree.

Orcus australasiæ Boisd. chalybeus Bois.



Figure 214. Orcus chalybeus. Psyllobora deficiens Cas. Rhizobius lophanthæ Bla.



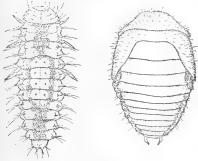
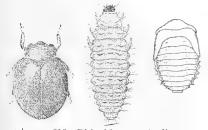


Figure 215. Rhizobius lophanthæ. ventralis Er.



rigure 216. Rhizobius ventralis.

separata Cas. tædata-20-maculata. 20-maculata Ccymnillus aterrimus Horn. Scymnus adventa Cas. aluticollis Cas. ardelio Horn. atramentarius Boh. bisignatus Horn. blaisdelli Cas. calaveras Cas. californicus (undetermined.) caurinus Horn. cervicallis Cas. cinctus Lec. collaris Cas. coniferarum Cr. debilis Lec. dificilis Cas extricatus Cas. flebilis Horn. guttulatus Lec. humboldti Cas. infuscatus Lec. jacinto Cas. iacobianus Cas. lacustris Lec. lecontei-cinctus. Iophanthæ Ril. luctuosus Cas. marginicollis Man.



Figure 217. Seymnus marginicollis.

mendocino Cas. mimus Cas. namus Lec. nebulosus Lec.



Figure 218. Scymnus nebulosis.

pacificus Cr. pallens Lec.

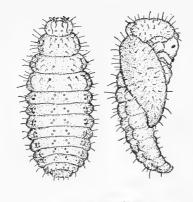




Figure 219. Stethorus picipes.

phlepsi Cr. punctum Lec. saginatus Cas. sarpeton Cas. scitus Cas. solidus Cas. sonomæ Cas. sordidus Horn. strenuus Cas. stygicus Cas. suavis Cas. suturalis Lec. tædatus Cas. tahoensis Cas. tenuivestris Cas. ovalis Lec. platyceps Cas. reversa Cas. picipes Cas. Smilia atronitensCas. Stethorus picipes cas. Vedalia cardinalis-Novius.

Zagloba ornata Horn. Iaticollis Cas. orbipennis Cas.

LATHRIDIIDÆ.

Bonvouloiria parviceps-Metophthalmus. Calyptobium caularum—Holoparamecus. Cartodere argus Reit. quadrifoveolata Fall. Conionomus australicus Bel. constrictus Gyll. nodifer Westw. Corticaria compta- Melanophthalma americana. cylindrinota (undetermined). elongata Gyll. expansa-Melanophthalma americana. ferruginea Marsh. fulvinennis (undetermined). herbivagans-Melanophthalma similata. inopia Fall. lævis-Melanophthalma americana. morosa-Melanophthalma. distinguenda.

occidua Fall. planula Fall. prionodera-serrata. pusilla-Melanophthalma distinguenda. rufula-Melanophthalma distinguenda. salpinoides Mots. scissa-Melanophthalma americana. serrata Payk. simplex-Melanophthaima. tenella-Melanophthalma. tenuipes Fall. Dasydercus angusticollis Horn. granvellei-angusticollis. Enicmus aterrimus Mots. crenatus (Lec.)

crenatus (Lec.)
desertus Fall.
fictus Fall.
minutus Linn.
nigritus Fall.
sulcatus Fall.
suspectus Fall.

tenuicornis Lec.
ventralis Fall.
Fuchsina occulta Fa!!.
Holoparamecus caularum (Aube.)
kunzei Aube.
pacificus Lec.
singularis—kunzei.
Lathridius armatulus Fall.
costicollis—flavipennis Man.
crenatus—Enicmus.
flavipennis Man.
parviceps—Metophthalmus.
tenuicornis—Enicmus.

Melanophthalma americana Man.

casta Fall.

cylindrinota (undetermined),
distinguenda Cam.
gibbosa Herb.
incompta Fall.
insularis Fall.
pusilla (undetermined),
similata Gyll.
simplex Lec.
tenella (Lec.)
villosa Zim.
Metophthalmus parviceps (Lec.)
rudis Fall.
trux Fall.
Revelaria californicus Fall.

NITIDULINA

COLYDIIDÆ.

Aglenus brunneus Gyll.
Anchomma costatum Lec.
Aulonium æquicolle—paralleopipedum.
longulum Lec.
paralleopipedum [©]ay.
castaneum Say.
simplex—castaneum.
Coxelus pacificus Horn.
serratus Horn.
Deretaphrus oregonensis Horn.

Ditoma ornata Lec.
sulcata Lec.
complex Lec.
linearis Cr.
pusillus Lec.
servus Horn.
vergrandis Horn.
Oxylæmus californicus Cr.
Rhagodera tuberculata Man.
Synchita variegata Lec.

CUCUJIDÆ.

Brontes debilis (not California) dubius Fabr. truncatus-dubius. Cathartus advena (Waltl.) opaculus Lec. Cryptophagus advena-Cathartus. Cucujus clavipes. ferrugineus-Læmophlæus. pusillus Læmophlæus. puniceus-clavipes. Dermestes surinamensis—Silvanus. Læmophlæus bigutatus Say. cephalotes Lec. ferrugineus (Steph.) horni Cas. longicornis Man. nitens Lec. puberulus—pusillus. pubescens Cas.

pusillus Schon.

Lathropus dubius-Brontes.

pubescens Cas. vernalis Lec. Narthesius grandiceps-striaticeps. simulator Cas. striaticeps Fall. Nausibius clavicornis Klug. Pediacus depressus Herbst. fuscus Er. Prostomis americana Crotch. mandibularis Fabr. Silvanus advena-Cathartus. bidentatus Fabr. gilæ Cas. imbellis Lec. mercator Fauv. nitidulus—planatus. opaculus—Cathartus. planatus Germ. surinamensis (Linn.) Telephanus lecontei Cas.

BYTURIDÆ.

byturus grisescens Lec.

PHALACRIDÆ.

Acylomus nebulosus Cas. Eustilbus apicalis Mels. aquatilis Lec. nanulus Cas. notabilis Fall. obtusus Lec. Olibrus aquatilis Lec.

obtusus Lec. rufipes Lec. piceus (undetermined). wickhami Cas. Phalacrus conjunctus Cas. ovalis Lec. penicellatus Say.

OSTOMIDÆ.

Alindria teres Mels. Gynocharia pilosula Crotch. oregonus Cas. Nemosoma fissiceps Fall. cylindricum Lec. Peltis ferruginea Linn. pippingskoeldi Man. Pseudalindria fissipes-Nemosoma. Temnochila chlorida Man. yuccæ Cr. Tenebroides californica Horn. corticalis Mels. crassicornis-mauritanica.

intermedia Horn.

mauritanica Linn. pleuralis Horn. sinuata Lec. Trogosita californica — Tenebroides sinuata. crassicornus-Tenebroides mauritanica. intermedia—Tenebroides. mauritanica—Tenebroides. pleuralis-Tenebroides. sinuata-Tenebroides. virescens-Temnochila chlorida. yuccæ-Temnochila. chlorida-Temnochila.

MONOTOMIDÆ.

Bactridium striatum (Lec.) striolatum (Reit.) Furops longicollis Horn. Monotoma marinum-Phyconomis. mucida Lec. picipes Herbst.

rufipennis-Hesperobænus. striatum-Bactridium. Phyconomis marinus Lec. Hesperobænus appreviatus (Mots.) Rhisophagus abbreviatus-Hesperobæstriolatum-Bactridium.

NITIDULIDÆ.

Amartus rufipes Lec. tinctus (Man.) Athonæus agavensis (Cr.) Brachypterus troglodytes Murr. Carpophilus brachypterus (Say). californicus Sch. caudalis-discoideus. decipiens Horn. dimidiatus (Fabr.) rickseckeri Fall. discoideus Lec. hemipterus Linn. niger (Say.) pallipennis (Say.) yuccæ Cr.

Cercus niger-Carpophilus. pallipennis-Carpophilus. sericans Lec. Cybocephalus californicus Horn. Epuræa ambigua Man. avara (Rand.) brachypterus-Carpophilus. decipiens-Carpophilus. dimidiatus—Carpophilus. discoideus-Carpophilus. hemipterus-Carpophilus. monogama Cr.

niger-Carpophilus.

nubilia-avara.

ovata Horn.
pallidipennis—Carpophilus.
scaphoides Horn.
truncatella Man.
yuccæ—Carpophilus.
Glyschrochilus cylindricus (Lec.)
vittatus (Say).
Ips cylindricum—Glyschrochilus.
vittatus—Glyschrochilus.
Meligethes brassicæ Scop.
Nitidula avara—Epureæ

brachypterus-Carpophilus.

dimidiatus-Carpophilus.

rufimanus Lec.
runcatus—Colastus,
ziczac Say.
Omosita discoidea Fabr.
inversa—discoidea.
Perthalycra murrayi Horn.
Pithyophagus rufipennis Horn.
Pocadius dorsalis Horn.
Rhizophagus abbreviatus Mots.
puncticollis Boh.
scalphiratus Man.
Smicrips hypocopoides Reit.
Strangylus tinctus—Amartus.
Tribrachys caudalis—Carpophilus.

CRYPTOPHAGIDÆ.

Atomaria fuscicollis Man.
lætula Lec.
Cryptophagus californicus Man.
cellaris Scop.

humeralis-ziczac.

debilis Lec. lecontei Gem. Henoticus serratus Gyll.

EROTYLIDÆ.

Dachne californica (Horn.)
picea Lec.
Engis californica—Dachne.
Erotylus boisduvali Chev.
californica—Tritroma.

Languria californica Fan.
convexicollis Horn.
Triplax californica—Tritroma.
Tritroma californica Lec.

MYCETOPHAGIDÆ.

Beetles of this family feed on fungi.

Berginus pumilus Lec. Litargus balteatus Lec. transversus—balteatus. Mycetophagus californicus horn.

Myrmechixemis latridioides Cr. Triphyllus elongatus Lec. Tryphœa fumata Linn.

DERMESTINA.

BYRRHIDÆ.

Amphicyrta chrysomelina Er.
dentipes Er.
elongata—dentipes.
gentilis—dentipes.
oblonga—dentipes.
parvuliceps—dentipes.
ventricosus—dentipes.
Eothriophorus minutus Lec.
Byrrhus cyclophorus Kirby.
Cytillus mimeticus—sericeus.
sericeus Forst.
Limnichus analis Lec.
californicus Lec.

densissimus Cas,
evanescens Cas.
naviculatus Cas.
nebulosus Lec.
perforatus Cas.
perpolitus Cas.
tenuicornis Cas.
Pedilophorus formosus Cas.
oblongus Lec.
satelles—formosus.
Simplocaria inflata—simplicipes.
simplicipes Man.
puncticeps—simplicipes.

NOSODENDRIDÆ.

Nosodendron californicum Horn.

DERMESTIDÆ.

The Dermestidæ feed on dried animal matter such as museum specimens and are sometimes troublesome by attacking hams and bacon.

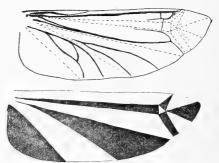


Figure 220. Wing of a Dermestid beetle.

Anthrenus apicalis-Crypterhopalum. conspersus-scrophulariæ. lepidus-scrophulariæ. obtectus-scrophulariæ. occidens-scrophulariæ. pictus-scrophulariæ. scrophulariæ Linn. suffusus-scrophulariæ. varius-verbasci. verbasci Linn. Attagenus hornii Jayne. pellio Linn. perplexus Jayne. piceus Oliv. rufipennis Lec. unicolor (undetermined). Cryptorhopalum affine Cas. apicale Man. balteatum Lec. filitarse Cas. fusculum Lec. nigricorne Lec. Colastus agavensis-Athonæus limbalis Lec. obliquus-truncatus. tinctus-Amartus. truncatus (Rand.) yuccæ-Carpophilus. Conoteles mexicanus Murr.

Cryptarcha concinna Mels.

ruficorne Lec. tristis Lec Dermestes caninus Germ. carnivorus Fabr cylindricum—Perimegatoma. falsum-Perimegatoma. lardarius Linn. lupinus-vulpinus. mannerheimii Lec. marmoratus Lec. rattus Lec. signatus Lec. talpinus Lec. triste (undetermined) vulpinus Fabr. Orphilis glabratus-niger. niger Rossi. subnitidus-niger. Perimegatoma ampia Cas. cylindricum (Kirby). falsum (Horn). jaynei Cas. variegatum Horn. Trogoderma brevis Cas. ornatum Say. pollens Cas. simulans Cas. sternale Jayne. varipes Cas.

HETEHOCERINA

GEORYSSIDÆ.

These beetles live on the margins of streams covering themselves with a mass of wet sand.

Georyssus californicus Lec. Dryops productus Lec.

striatus Lec. suturalis Lec.

Elmis divergens Lec.
foveatus Lec.
quadromaculatus Horn.
seriatus Leec.

productus—Dryops.
Helicus gilensis—Dryops suturalis.

PARNIDÆ.

productus—Dryops. striaus—Driops. suturalis Driops.

Lara avara Lec.

Macronynchus parvulus Horn.
Pelonomus cavifrons Lec.
haldemanni Horn.

Tnroscinus crotchii Lec.

HETEROCERIDÆ.

The members of this family live in burrows in wet sand on the banks of streams.

Heterocerus brunneus Mels.

collaris Kies. gemmatus Horn. gnatho Lec. labiatus—gnatho. luteolus—gnatho. pusilla Say.

HISTERINA.

HISTERIDÆ.

The Histeridæ live on dry partly decayed substances both animal and vegetable and are notable by their hard bodies and their habits of retracting their legs into grooves and appearing as dead.

Abræus bolteri Lec.

Acritus basalis Lec. maratimus Lec.

volitans Fall. Æletes basalis Lec.

Anapleus compactus—marginatus.

marginatus Lec. Bacanius globulinus Cas.

Carcinops æqualis Say.

dificilis Horn. 14-striatus Steph. gilensis Lec.

opuntiæ Lec. tejonicus Horn. tenellus Erich.

Dendrophilis californicus Horn.

Epierus decipiens Lec.

planulus Er. regularis Beam.

Gnathoneus interceptus—Saprinus ro-

tundatus.

Hetærius californicus Horn. morosus Lec.

tristriatus Horn.

Hister Limaculatus Linn.

californicus Mars.

fractifrons Cas. gagates Fall. lecontei Horn.

immunis Er. Iucanus Horn.

militaris Horn. punctiger Lec.

remotus Lec.

simplicipes Fall. umbilicus Cas. Hololepta cacti Lec. bractea Fr. helena Lec. fossularis (not California).
marginata Lec. pervalida Bla. populnea Lec. princeps—yucateca. vicina Lec. vulcateca Lec. yucateca Mars. Onthophilus lecontei Horn. Pachylopus gaudens-Saprinus. serrulatus—Saprinus. Scaphisoma castaneum Lec. sulcifrons—Saprinus. Paromalus difficilis Horn. mancus (undetermined.) Platysoma punctigerum Lec. Plegaderus consors Horn. fraternus Horn.

sexstriatus Lec.

Saprinus æquipunctatus Horn.
alienus Lec.
behrens.i Horn.
bigemmeus Lec.
cærulescens Lec.
ciliatus Lec.
consobrinus Fall.
discoidalis Lec.
distinguendus Mars.
densipunctatus Horn.
estriatus Lec.

nitidus Horn.

molestus (undetermined).

fimbriatus Lec. gaudens Lec. insertus Lec. interceptus-rotundatus. interstitialis Lec. intritus Cas. laridus Lec. lentus Cas. liticollis Fall. lubricus Lec. lucidulus Lec. lugens Er. obductus-lugens. obscurus Lec. opacellus Cas. oregonensis Lec. pæminosus Lec. neglecta Blais. platysma Lec. populnea Lec. patruelis Lec. pectoralis Lec. plenus Lec. propensus Cas. rotundatus Kug. rotundifrons Mars. scissus Lec. sejunctus—distinguendus. serrulatus Lec. sulcifrons Lec. vestitus Lec. vituosus Lec. Teretrius obliquulus Lec. placitus Horn. Tribalister marginellus Lec.

SCAPHIDIIDÆ.

rufulum Lec.

Tribalis californicus Horn.

TRICHOPTERYGINA

HYDROSCAPHIDÆ.

Hydroscapha natans Lec.

TRICHOPTERYGIDÆ.

Trichopteryx californicum Mat. crotchii Mat. laticollis Maek.

volundala Mots. sitkænsis Mots. Smicrus filicornis Fair.

PTILIIDÆ

Actidum attenuatum Cas. granulosum Cas. politum Mat. robustulum Cas. Motschulskium sinuaticolle Mat. Ptilium collani Maek.

columbianum Mat. humile Mat. Ptenidium pullum Maek. Ptilium collani-Ptenium. columbianum-Ptenium.

SPHÆRIIDÆ.

Sphærius politus Horn.

SILPHINA

SILPHIDÆ.

The Silphidæ are the carrion beetles. A few species have been called burying beetles because of their habit of excavating beneath the dead animal upon which they are feeding and upon which they lay their eggs.

SYNOPSIS OF GENERA.

Necrophorus: antennæ ten-jointed.

Silpha: front coxal cavities widely open behind.

Necrophilus. Pinodytes: eyes wanting. Sphærites: antennæ capitate. Agyrtes: epipleural fold narrow. Pteroloma: antennæ scarcely thickened at tip. Pelates: antennæ arising under a frontal margin.

Agyrtes longulus Lec.

Hister glabratus-Sphærites.

Necrophilis hydrophiloides Man. confossor—pustulatus. longulus—Agrytes.

tenuicorne—Pteroloma.

Necrophorus guttula Mots.

marginatus Fabr. nigritus-pustulatus.

pustulatus Hersch. vespilloides Herb.

pollinctor—vespilloides.

Pelates lautus Man.

Pelates tenuicorne-Pteroloma. Pinodytes cryptophagoides Man. pusio (Horn.) Pteroloma tenuicorne Lec. caraboides Fall.

Silpha ænescens-ramosa. californica-lapponica.

lappanica Herb. opaca Linn. ramosa Say.

Sphærites glabrates Fabr. Sphærites pusio-Pinodytes.

ANISOTOMIDÆ.

Agathidium californicum Horn.

concinnum Man. pulchrum Lec. revolens Lec.

sexstriatum Horn. virile Fall.

Amphicyllis picipennis-Cyrtusa.

Anistoma collaris Lec.

curvata Man. dificillis Horn. humeralis Horn. morula-curvata. obsoleta (Mels.) paludicolla Crotch.

Catops basillaris-Choleva. californicus—Ptomophagus. cryptophagoides-Pinodytes.

pusio-Ptomophagus. Choleva basillaris (Say).

californicus-Ptomophagus.

clavatum-Colon. inerme-Colon.

Iuridipennis Man. pusio-Ptomophagus. Colon celatum Horn. clavatum Man. nevadense Horn. inerme Man. Cyrtusa picipennis (Lec.) Hydnobius latidens Lec. longulus Lec. matthewsii Crotch.

Liodes confusa Horn. numilis-latidens.

strigilatus Horrn. Pallodes obsoleta-Anistoma. Platycholeus leptinoides (Crotch). Ptomophagus californicus (Lec.) californiscus (Lec.) consobrinus (Lec.) fissus Horn. leptinoides-Platycholeus. pusio (Lec.) Triarthron cedonulli-lecontei. lecontei Horn.

CLAMBIDÆ.

Clambus seminulum Horn.

SCYDMÆNIDÆ.

Brachycepsis fuchsi Brend. Catalinus angustus (Lec.) Cephennium anophthalmicum Brend. Ceramphus deformata (Horn.) Connophron digressum Cas. occidens Cas. Drastophus lævicollis Cas. Eumicris caseyi Brend. Eutheia colon—Veraphis. impressa-Veraphis. Lophioderus gracilis Lec. myops Cas. ventricose Cas.

Papusus macer Cas. Scydmænus angustatus-Catalinus. californicus Mots. colon-Veraphis. deformata-Ceramphis. fuchsi Brend. gracilis-Lophoderus. ovipennis Cas. ovithorax Brend. pacificus Cas. sparsus Lec. Veraphis colon (Horn). impressa (Lac.)

CORYLOPHIDÆ.

Ænigmaticus californicus (undet.) Sacium amabile Lec. Clypeaster discolor-Sacium. scitulus-Sacium. Sericoderus flavidus Lec.

decolor Lec. scitulum Lec.

STAPHYLININA

CLAVIGERIDÆ.

Adranes dietzii Sch. pacificus Wick. taylori Wick. candidum Cas. maurinicum Cas.

pacificum Cas. politum Cas. robustum Cas. testaceum Cas. Fusiider californicus Cas.

PSELAPHIDÆ.

Actium bifoveatum Cas. brevipennis Cas. californicum—fuchsii. pluriguttatus Lec. Articerus californicus Brend.

fuchsii Brend. Batrisodes cicatrosis (Brend.) denticauda (Cas.) lustrana Cas. mendocino Cas.

monticola (Cas.) grandiceps (Cas.) occidens (Cas.) isabellæ (Lec.) longicollis (Cas.) pygidialis (Cas.) speculum (Cas.) rubida (Cas.) Pselaptrichus tuberculipalpus Brend. tulareanus Cas. zephrinus (Cas.) informis Cas. Batrisus cicatrosis—Batrisoides. nevadensis Cas. denticauda-Batrisoides. Pselaptus belfragei Lec. monticola—Batrisoides. occidens—Batrisoides. Reichenbachia albionica Cas. arthritica Cas. deformata-taphrocera. pygidialis-Batrisoides. zephyrinus-Batrisoides. fallii Cas. Biotus formicarius Cas. fundata Cas. Bryaxis albionica Mots. depressifrons Brend. compar-franciscanus. fusticornis Cas. deformata Lec. subtilis Cas. depressifrons Brend. taphrocera Cas. foveata Lec. tumidicornis Cas. franciscanus Cas. tumerosa Cas. loripes Cas. turgidicornis Cas. wickhami Brend. sagax Lec. subtilis Lec. Rhexidius asperulus Cas. Ctenistes pulvureus-Sognorus. granulosus Cas. Sagola cavifrons-Prosagola. Ctenisis dispar Sharp. raffrayi-dispar. corticina-Prosagola. Decarthron brendeli Cas. grandiceps-Prosagola. Euplectus californicus Cas. isabellæ-Prosagola. orbiceps Cas. longicollis-Prosagola. Faronus isabellæ-Prosagola. rubida-Prosagola. Morius occidens Cas. subsimilis Cas. Scalenarthrus hornii Lec. Oropus abbreviatus Cas. castaneus Cas. Sognorus pulvereus Lec. cavicauda Cas. Trimium californicum Lec. curvipennis Cas. Tychus bipuncticeps-cognatus. debilis Cas. cognatus Lec. interruptus Cas. hexagonus Cas. montanus Cas. puberulus Lec. striatus Lec. puberulus Lec. testaceus Cas. sonomæ Cas. tenellus Lec. Pilopius pulverens Lec. Prosagola cavifrons (Cas.) Tyrus corticinus Cas.

STAPHYLINIDÆ.

Ababectus pallidiceps Cas.
Acrotona absona Cas.
ardelio Cas.
digesta Cas.
malaca Cas.
servera Cas.
shastanica Cas.
Actobius elegantulus Horn.
formosusFall.
gratus Lec.

corticina (Cas.)

infirmis Horn.
ochreaus Horn.
pæderiodes (Lec.)
puncticeps Horn.
semibunctatus Horn.
senilis Horn.
sobrinus Er.
Acutalia elegans Cas.
Acylophorus gilensis—pronus.

pronus Er.

Valda frontalis Cas.

Adota gnypetoides—Atheta
definita—Atheta.
insons—Atheta.
pavidula—Atheta.
scolopacina—Atheta.
scortea—Atheta.
subintima—Atheta.
Aidochara planiventris Cas.
Aleochara castaneipennis—Baryodma.
puberula Klug.
sulcicollis—Eucharina.
tahoensis Cas.
yalida—Maseochara.

verna-Baryodma.

Ancæus californicus (Lec.)
Ancyrophoma annectens—naploderus.
planus Lec.
Anepsiota insignis—Atheta.
shastana—Atheta.
torpens—Atheta.
Anthobium atriventre Cas.
aurifluum Fauv.
californicum Fauv.
diversicolle Cas.
fraternum Cas.
gilvipenne Cas.

nigerimum Cas.

punctatum Cas.

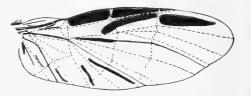




Figure 221. Wing of a Staphylimid -etle.

Aloconota perdita Cas. Amanusa angustula Cas. spissula Cas. Amischia colonia Cas. devincta Cas. Amphicraum alutaceum Cas. binotatum Cas. crassicorne Cas. crassicorne Cas flaviscens Cas. floribundum Lec. maculatum Lec. modestum Cas. opaculum Fauv. pallidum Cas. pilosellum Cas. puberulum Fauv. scutatum Fauv. sparsum Fauv. testaceum Man.

subangulatum Cas. tibiale Cas. Aploderus mimeticus Fall. princeps Cas. trinifer Fall. Aploderus annectana-Haploderus. cephalotes—Haploderus. flavipennis—Haploderus. lineolus-Haploderus. Apocellus analis Lec. gracilicornis Cas. sphæricollis (Say.) Arisota pomonensis Cas. speculifer Cas. umbrina Cas. Artochia productifrons Cas. Asemobius cælatus Cas. Atheta alamedana Cas. aperta Cas. audens Cas.

barbaræ Cas. bicariniceps Cas. blandita Cas. civica Cas. coriaria Kra. definita Cas. dunni Cas. filiola Cas. fugitans Cas. gnypetoides Cas. importuna Cas. informalis Cas. insignis-Athetota. insons Cas. intacta Cas. lepidula Cas. loquax Cas. Iuscitosa Cas. marinica Cas. meticulosa Cas. neutralis Cas. novicia Cas. oraria Kra. oscitans Cas. paganella Cas. pavidula Cas. perpera Cas. perspecta Cas. perversa Cas. picipennis Man. prolata Cas. querula Cas. repaxa Cas. repens Cas. repensa Cas. saturata Cas. scolopacina Cas. scortea Cas. setositarsis Cas. shastana Cas. socors Cas. stoica Cas. subintima Cas. timida Cas. terpens Cas. Athetota insignis (Cas.) Athetalia bicariniceps—Atheta. repensa—Atheta. Autalia copiosa Cas. elegans Cas.

Bamona falliana Cas.

tenuissima Cas.

Baptolinus fraternus Cas.

punctiventris Cas.

Barothnius californicus (Man.) Bariodma castaneipennis Esch. bimaculata Grau. denseventris Cas. eludens Cas. imbricata Cas. innocua Cas. minuta Cas. nitidicollis Cas. obsolescens Cas. robustula Cas. salicola Cas. tolerata Cas. uvidula Cas. verna Say. Belonchus epippiatus (Say). Bisnius procerulus Grav. Blaptolinus fraternus Cas. punct iventris Fall. Bledius apicalis Fall. armatus (Say). bicolor Cas. clarius Fall. cribricollis Lec. deceptivus Fall. diagonalis Lec. episcopalis Fall. eximius Cas. ferratus Lec. flavipennis Lec. foraminosus Cas. forcipatus Lec. fratellus Fall. gentilis Cas. gracillus Cas. gradatus Fall. iacobinus Lec. laticollis Lec. lectus Cas. luteipennis Lec. monstratus Cas. monticola Cas. nitidiceps Lec. opacifrons Lec. ornatus Lec. parvicollis Cas. persimilis Fall. piceus Fall. plytocinus Lec. pleuralis Lec. punctatissimus Lec. regularis Fall. relictus Fall. ruficornis Lec.

rusticus Fall. torvula Cas. specularis Fall. zephyrina Cas. strenuus Cas. Conosoma bipustulatum (Grav.) tallaci Fall. bisignata-bipustulatum. villosus Cas. casaneum Horn. Boletobius biserriatus Man. Creophilus viliosus (Grav.) cingulatus Man. Cryptobium californicum Lec. cincticollis Say. pacificum-Hesperobium. Bolitochara californica-Stictalia. pimerianum-Gastralobium. nigrina-Stictalia. timicum-Hesperobium. Bratinus californicus Cas, Dalotia pectorina-Dimetrota. Bryobiota bicolor (Cas.) Datomicracoruscula Cas. Bryoporus rufescens Lec. insolida Cas. Cafius canescens Maek. perpaula Cas. decipiens Lec. pomonæ Cas. Deleaster concolor Lec. dubius (Lec.) b liphrum æquicolle Cas. femoralis Maek. occiduum Cas. nthocarinus Horn. luteipennis Horn. Delphota audens-Atheta. fugitans-Athea.. opacus Lec. importuna-Athea. seminitens Horn. sulcicollis (Lec.) intacta-Atheta. Calcdera attenuata Cas. lepidula-Aheta. loquax-Athea. Calcderma angulata Cas. novicia-Atheta. brevipennis Cas. oscitans-Atheta. continuens Cas. repaxa-Atheta. contracta Cas. discolor Cas. socors-Atheta, exilis Cas. stoica-Atheta. Dianusa bakeri-Eucryptusa. luculenta Cas. pasadenæ Cas. mobilis Cas. Dimetrota cerebrosa Cas. paliens Cas. peregrina Cas. immerita Cas. reducta Cas. incredula Cas. rugosa Cas. opinata Cas. semibrunnea-rugosa. pectorina Cas. tentilla Cas. resima Cas. Calochroa rubripennis Cas. spectator Cas. vacunalis Cas. Cileasilphoides Linn. Colusa brevicornis-Echidnoglossa. vigilans Cas. erilis-Echidnoglossa exima. Echidnoglossa æmula Cas. brevicornis (Cas.) exima-Ech dnoglosa. gracilis-Echidnoglossa. concinna Cas. grandicollis—Echidnoglossa. clavicauda Cas. valida-Echidnoglossa. defecta Cas. Colpodota abdicans Cas. eminens Cas. egens Cas. exilis-eximia. fatigans Cas. eximia (Cas.) inceptor Cas. gaudens Cas. laxella Cas. gracilis (Cas.) parva Sahl. grandicollis (Cas.) pupilla Cas. leviventris Cas. repentina Cas. ludibunda Cas. sonomana Cas. strangulans Cas.

occidua Cas. placidula Cas. quadripennis Cas. Gyrohypnus dimidiatus (Lec.) tenuicornis Cas. hamatus (Say). infumatus (Cas.) valida (Cas.) ventralis Cas. mollinus Cas. Eleusis fascietus (Lec.) nanus (Cas.) picipennis (Lec.) nigrellus (Lec.) Emplenota arenaria (Cas.) pusillus (Cas.) pacifica (Cas.) Gyronycha attenuata Cas. quadrifer Cas. longipennis Cas. trilimbata Cas. obscura Cas. Habrocerus tarsalis Cas. Engamota absona-Acrotona. Erochomus punctipennis Lec. Habrolinus tahoensis Cas. Eucharina cylindrella Cas. Hadrotes crassusMan. debilicornis Cas. villosus-Creophilus. sulcicollis (Man.) Haploderus annectens (Lec.) tibialis Cas. cephalotes Cas. Eucryptusa bakeri Cas. tlavipennis (Cas.) fragilis Cas. linearis (Lec.) Hemithecta ruficollis-Thecturota. Euliusa citrina Cas. elsinorica Cas. Hesperobium pacificum (Cas.) tumidum (Lec.) laticollis Cas. limatula-Gnypeta. Hesperolinus angustus Cas. mollis (Cas.) bicolor Cas. sparsella Cas. brunnescens-parcus. parcus (Lec.) transversa Cas. piceus Cas. Falagriota asperula Cas. collaris Cas. pomonæ Cas. Heterothrops californicus-fumigatus. evanescens Cas. lucida Cas. carbonatus Fall. occidua (Cas.) fumigatus Lec. parvipennis Cas. mediocris Fall. picina Cas. occidentalis Cas. pusio Lec. Falagria cavipennis—Tachyota. Homalium algarum Cas. laticollis-Euliusa. læviuscula-Lissagria. alutaceum Fauv. occidua-Falagriota. ater Cas. Gænima impedita Cas. cæsum Cas. Gastrolobium pimerianum (Lec.) exsculptum Maek. Geodromicus humboldtearum Cas. fractum Fauv. temporalis Cas. humile Maek. Glyptoma costale Er. lapponicum Zett. Gnypeta cerebropunctata (Cas.) longulum Maek. curtipennis Cas. megarthroides Fauv. experta (Cas.) pacificum Cas. harfordi (Cas.) plagiatum Man. impressicornis Cas. pusillum Grav. leviventris Cas. repandum Er. Iimatula Cas. rivulare Pavk. linearis (Cas.) rugipenne Cas. lucens-Eliusa. strigipenne Maek. oblata Cas. thevineti Fauv. sensilis Cas. Homalota hesperica Cas. opaca-Pontomolata. Gnypetella laticeps (Cas.)

Homalotusa tahoensis Cas. Hydromecta benigna Cas. callidula Cas. jugalis Cas. subpollaris Cas. Illobates californicus Cas. nigrinus Cas. lotata tepida Cas. unica Cas. Ischnoglossa alticola Cas. Isoglossa pellax Cas. Isomalus fasciatus-Eleusis. nigrellus—Eleusis. Lathrinæum atrocephalum Gyll. nigropiceum Cas. pictum Fauv. spretum Cas. subcostatum Maek. Lathrobium californicum Ltc. franciscanum Cas. iacobinum Lec. lituranium—Linolathra. puncticeps Lec. sphæricollis-Apocellus. subseriatum Lec. Leptacinodes nigritulus (Lec.) pallidulus (Lec.) Leptacinus brunneaccens-Hesparolinus parcus. ${\rm nigritulus} \textcolor{red}{--} \textbf{Leptascinodes.}$ pallidulus-Leptacinus. parcus-Hesparolinus. Leptolinus grandiceps-Stictolinus. parcus-Hesparolinus. Leptorus californicus-Scopæus. longinennis-Scopæus. texanus-Scopæus. Lestera fusconigra (Cas.) Leucopæderus ustus (Lec.) Leucorus Iuridus Cas. Linolathra lituraria (Lec.) Liparocephalus brevipennis Maek. cordicollis Lec. Lispinus californicus Lec. linearis Er. Lithocharis alutacea Cas. ochracea Grav. quadricollis Cas. Lomechusa angustata Fall.

montana Cas. Maseochara basalis Cas.

fustiger Cas.

insignis Cas.

californica-valida.

puberula Cas. valida (Lec.) Medon consanguinea Cas. contigua Cas. convergens Cas. gregalis Cas. languida Cas. latiuscula Cas. lepida Cas. luctuosa Cas. malaca Cas. mimula Cas. puberula Cas. retusa Cas. sinuaticollis Cas. sublesta Cas. Megarthus pictus Cas. Melanalia larvalis Cas. tabida Cas. tetricula Cas. Metaxia adjuncta Cas. famula Cas. fatua Cas. subfusca Cas. Microdota alamedana-Atheta. perversa—Atheta. repens-Atheta. saturata-Athet. Migarthrus pictus Cas. Microglossa grandiseps Cas suturalia Man. Micropeplus costatus Lec. punctatus Lec. tesserula Curt. Mycetoporus hospitalis Fall. humidis Cas. lepidus Er. myops Fall. neotomæ Fall. Mymerdonia fauveli Sharp. shastanus Cas. sonomæ Cas. Nicrodota alamedana-Atheta. perversa-Athea. repens-Atheta. saturata-Atheta. Nemota filiola—Atheta. informalis-Atheta. meticulosa—Atheta. perpera-Atheta. perspecta-Atheta. timida-Atheta.

Ocalea franciscana Cas. grandicollis Cas. Oligopterus cuneicollis Cas. Oligata pucillima Cas. Olisthæus megacephalus Zett. Oligomia perpaula-Datomiera. Oligota oviformis Cas. Omegalia abjecta Cas. vieta Cas. Orobanus densus Cas. rufipes Cas. simulator Lec.

Orus cervicula Cas. decaptor Cas. distinctus Cas. femorata Fauv. filius Cas. fraternus Fall. montanus Fall. punctatus Cas. robustulus Cas.

Othius californicus-Barothnius.

Oxypoda californicus Cas. cernua Cas. cruda Cas. fusiformis Cas. insignis-Athetota. modescans Cas. nimbata Cas. olescans Cas. recensa Cas.

Oxymedon rubrum Cas. Oxytelus armatus-Bledius.

montanus Grav. niger Lec. nitidulus Grav. sculptus Grav. sobrinus Lec. vergrandis Cas.

Ousipalia hesperica Cas. pacifica Cas.

Pachystilicus quadriceps (Lec.) Pæderillus compotens-Pæderus femoralis.

Pæderus compotens-femoralis. femoralis Lec.

ustus-Leucopæderus. Palaminus lividus Lec.

Panalota setositarsalis-Atheta.

Paradilacra erebea Cas. memnonia Cas. persola Cas. sinistra Cas. subpædua Cas. symbolica Cas. vulgatula Cas.

Paramedon pallidipenne Cas.

Parothius californicus Man. Phænogyra californica Cas. Philonthus albionicus Man.

alumnus Er. alutaceus Horn. bidentatus Horn. bucephalus Horn. californicus—fervidus. caurinus Horn. clunalis Horn. crotchi Horn.

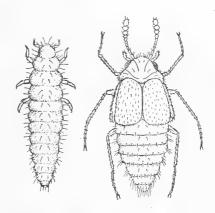




Figure 222. Oligota oviformis.

decipiens Horn. discoidens Grav. dubius-Cafius ferreipennis Horn. fervus Nord. filicornis Horn. flavolimbatus Er. grandicollis Horn. gratus-Actobius. hepaticus Er. instabilis Horn. lecontei Horn.

longicornis Steph. nigritulus Grav. nitescens Horn. pædaroides-Actobius. petteti Horn. picicornis Horn. picipennis Maek. politus Fabr. puberulus Horn. punctatellus Horn. quadrulus Horn. quisquelarius Gyle. semiruber Horn. siegwaldi Man. sordidus Grav. sulcicollis-Cafius. thermarum Aube. theveneti Horn. triangulum Horn. varians Payk. varicolor Bok. ventralis Grav. versutus Horn. virilis Horn. Phiceopora adversa Cas. iacobiana Cas. liberata Cas. Phloepterus longipalpus Cas. Phylosis bicolor-Bryobiota. Phytosus bicolor Cas. maritimus Cas. opacus Lec. Pinophilus densus Lec. Platystethus americanus Er. Platyusa sonomæ Cas. Placusa petulans Cas. striata Cas. vaga Cas. Polystoma arenaria-Emplenota. pacifica-Emplenota. Pontomalota californica Cas. nigriceps Cas. opaca (Lec.) Protinus basalis Cas. limbatis Cas. maklini Fauv. salebrosus Cas. sulcatus Cas. Pseudomedon capitulum (Cas.) Pseudopsis detrita Fall.

minuta Fail.

Pseudota præsaga Cas.

obliterata Lec.

Pseudorus prolixipennis Cas.

Pycnorus armiger (Fall.) Quedius capucinus (Grav.) debilis Horn. desertus Horn. erithrogaster-fulgidus. lævigatus (Gill.) limbifer Horn. prostrans Horn. seriatus Horn. transparens Mots. Quepisota insignis-Athetota. Ramona capitulum-Pseudomedon. Rheobioma disjuncta Cas. terrena Cas. marcida Cas. Rheocharella fenyesi Cas. Sableta immunis Cas. Scopæodera nitida Lec. sonorica Cas. Scopæus armiger-Pycnorus. brunnipes Cas. californicus Fall. longipennis (Fall.) punctatus Cas. rotundiceps-Scopæoma. texanus (Cas.) truncaticeps—Scopæoma. Scopæoma rotundiceps (Cas.) truncaticeps (Cas.) Siagonium punctatum Lec. Silusa californica Barn. decolorata Cas. valens Cas. vesperis-decolorata. Sipalia frontalis Cas. lippa Cas. Somatium oviforme Cas. Sonomata lippa-Sipalia. Stachygraphis maculata Lec. Staphylinus capicinus-Quedius. cinnamopterus Grav. ephinpiatus-Belonchus. fulgidus-Quedius. lævigatus-Quedius. luteipes Lec. nigrellus Horn. pleuralis Lec. raphynus Lec. rutilicauda Horn. saprinus Lec. tarsalis Lec. villosus-Creophilus. Stenus adelops Cas. aveolatus Cas.

arizoniæ Cas. californicus Cas. colonus Er. corvus Cas. costalis Cas. dives Cas. ellypticus Cas. exilis Cas. giliæ Cas. incultus Cas. insignis Cas. lætulus Cas. lucidus Cas. luctuosus Cas. luculentus Cas. pacificus Cas. pinguis Cas. pollens Cas. renifer Lec. sayi Cas. sculptilis Cas. subgriseus Cas. terricola Cas. tristis Cas. vacuus Cas. vestalis Cas. villosus Cas. zunicus Cas. Strictalia aspera Cas. bakeri Cas. brevicornis Cas. californica (Cas.) collaris Cas. laxicornis Cas. minor Cas. nigrina (Cas.) obsolescens Cas. punctiventris Cas. rugipennis Cas. Stilisus occiduus Fall. opaculus Lec. quadriceps-Pachystilicus. Stictolinus œqualis Cas. franciscanus Cas. grandiceps (Lec.) Strigota intrudens Cas. obliquata Cas. placata Cas. seclusa Cas. seducens Cas. Thinotus claviceps Cas. Sunius californicus Aust. Tilia cavicollis-fusconigra. longuisculus Man. filicornis-fusconigra. robustulus Cas. fusconigra Mots. similis Aust. rufitarsis-fusconigra. tenuiventris Cas. Trachiota cavipennis Cas.

trinotatus-longuisculus. trisignatus-longiusculus. Tachinus agilis Horn. angustatus Horn. debilis Horn. exasperata Cas. faceta Cas. harfordi Cas. instabilis Maek. laticeps Cas. linearis Cas. memnonius Grav. pallipes Grav. cemirufus Grav. tachyporoides Horn. Tachyporus bipustulatus-Conosoma. brunneus Fabr. californicus Horn. nitidulus-californicus. Tachyusa arida Cas. cerebropunctata-Gnypeta. experta-Gsypeta. faceta Cas. harfordi-Gnypeta. laticeps— Gnypetella. linearis—Gnypeta. vespertina Cas. Tanyrhinus singularis Maek. Tarphiota fucicola Maek. hirsutulla Cas. iota Cas. lativentris Cas. litorina Cas. pallidipes (Cas.) Taxicerella immunis-Sabieta. Terasota perdita-Alconota. Tetrallus bernhaueri Cas. trinitalis Cas. Thiasopila asperata Cas. Thinobius gracilicornis Cas. hesperiusCas. macropterus Lec. oxytelinus Lec. sonomæ Cas. validus Cas. Thinopinus pictus (Lec.) variegatus—pictus. Thinusa maritima Cas. obscura Cas.

lativentris Cas.
Trichocanthus pictus—Thinopinus.
Trigonurus crotchii Lec.
edwardsii Sharp.
Trogophicus armatus Cas.
bladiinus Lec.
confinis Cas.
debilis Cas.
dentiger Cas.
diffusus Cas.
filum Cas.
giliæ Cas.
lathocarinus Lec.
obliquus Cas.
occidens Cas.

pacificus Cas.

pauperculus Cas.

prominens Cas. sculptilis Cas. tantilius Cas. Unamis truncata Cas. Valenusa parallela Cas. Vellica longipennis Cas. Xantholinus cephalus-Nudobius. diminutus-Gyrohypnus. hamatus-Gyrohypnus. nanus-Gyrohypnus. obscurus Er. picipennis-Gyrohypnus. pusillus-Gyrohypnnus. Xanthopygus cacti Horn. Zalobius serricollis Lec. spinicollis Lec.

HEMIPTERA.

The Order Hemiptera is the last great group with simple metamorphosis and the first group to deviate from the simple type of mouth structure. The great majority of the species have a metamorphosis as simple as that of the Orthoptera but among scale insects and white flies the nymph is so

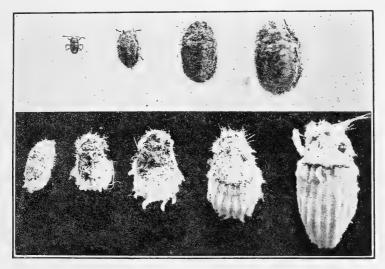


Figure 223. Stages in the growth of the cottony cushion scale.

modified that the change to adult condition seems to be as great as in the higher groups with complex metamorphosis and with an intermediate stage resembling a pupa but which is supposed to differ from a true pupa by 253

being able to take food. It is quite possible that some of these insects may have a true pupa.

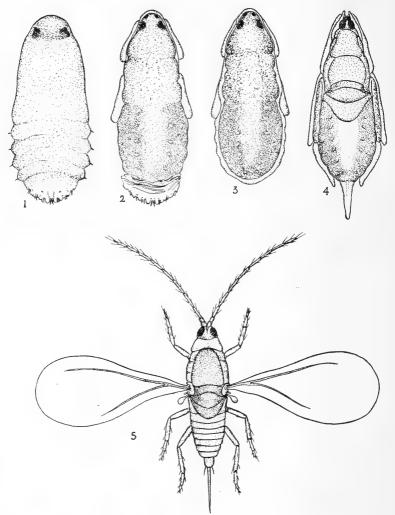


Figure 224. Development of the male of the purple scale.

The mouth parts were modified in this group to enable these insects to feed on the juices of plants and most of them are still plant feeders. The

mandibles and maxillæ have been converted into long hair-like organs, the latter uniting to form a single lancet. All three are enclosed in the enlarged labium. This generally consists of a number of telescopic joints (not exceeding five), which close up as the lancets are thrust into the plant.

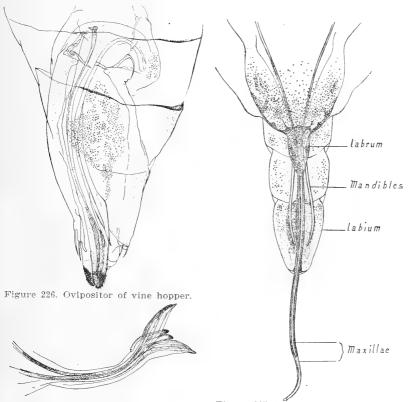


Figure 227. Ovipositor saws.

Figure 225. Mouthparts of vine hopper.

Economically the Hemiptera are of great importance, especially in an arid climate, because they withdraw the moisture from the plant when it can least afford to lose it. Plant lice and scale insects are the most important families as plant pests.

A number of groups have become predaceous on other insects. Among these certain Reduviids commonly known as kissing bugs can produce a painful bite. The bed bug is a case of one of these insects becoming a human parasite and the lice are even more strictly parasitic.

The classification of Hemiptera consists in the separation first of the thrips often as a distinct order then the lice also sometimes as a distinct order, and the division of the remainder into the Heteroptera and Homoptera, treated by English entomologists as separate orders. The aquatic Heteroptera form a natural group as does the Homopterous series including the scale insects and plant lice.

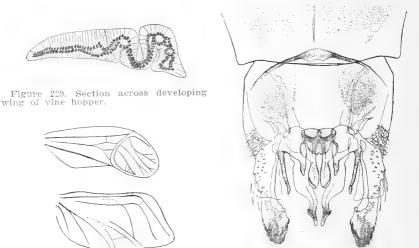


Figure 230. Wings of Heteropterous bug. Figure 228 Male organs of vine hopper.

SYNOPSIS OF FAMILIES.

Coccidæ: beak apparently from the breast and not jointed. Aleurodidæ: bind wings as large as front wings, if wingless with oval supraanal plate.

Jassidæ: hind legs enlarged, with rows of spines on tibiæ.

Aphidæ: beak apparently from breast. Psyllidæ: hind legs enlarged.

Capsidæ: wings with two cells beyond thickened portion and no longitudinal veins.

Lygæidæ: front legs slender, proboscis and antennæ four-jointed, and only a few longitudinal veins beyond the thickened portion of the wing. Berytidæ: body very slender.

Coreidæ: similar to Lygæidæ but with longitudinal veins numerous. Pyrrhocoridæ: no ocelli.

Pentatomidæ scutellum large. Cydnidæ, Corimelænidæ and Scutelleridæ: the first two with front tibiæ spinose and the last two with scutellum broadlf rounded behind.

Membracidæ: cheeks touching the front coxæ. Cicadidæ: three occelli. Fulgoridæ: antennæ beneath the eyes. Cercopidæ: pronotum not hiding the scutellum.

Reduviidæ: antennæ much larger than head and tarsi three-jointed. Cimicidæ: abdomen entirely exposed. Henicocephalidæ: the front wings membranous thruout. Nabidæ: proboscis three-jointed. Emesidæ: andPhymatidæ: front legs for grasping, the former with very slender body. Anthochoridæ: with an embolium. Saldidæ: proboscis reaching to middle coxæ.

Corisidæ: hind feet without claws. Notonectidæ: head not overlapping prothorax.

Aradidæ: similar to Reduviidæ but tarsi two-jointed. Tingidæ: wings

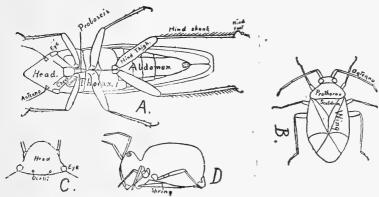


Figure 231. Diagrams showing structure of Hemiptera and Aptera.

longer than abdomen.

Belostomidæ: antennæ shorter than head. Nepidæ: body slender. Galgulidæ: with ocelli. Nancoridæ: legs not flattened.

Thripidæ: body very small and slender. Philocothripidæ: without an ovipositor. Heliothripidæ: ovipositor curving up.

Gerridæ: Legs as long or longer than body. Veliidæ: body widestat prothorax.

Pediculidæ.

SCUTELLARINA.

SCUTELLERIDÆ.

Aulacostethus similans Uhl. Camirus porosus Germ. Cimex torridus—Pachycorls. Eurygaster alternans Say. Homeomus proteus Stal. Odontoscelis VanD.

Pachycoris fabricii—torridus.
porosus—Camirus.
torridus Scop.
Tetyra alternans—Eurygaster.
Zophæssa porosa—Camirus.

CORIMELÆNIDÆ.

Corimelæna anthracina Uhl. cœrulescens Stal. ciliatus Uhl. cyaneus-cœrulescens.

extensa Uhl. Thyreocoris cœrulascens-Corimelæna.

PENTATOMINA.

PENTATOMIDÆ.

The members of this family feed for the most part on plants but some attack other insects. The harlequin cabbage bug, Murgantia, is an important

Arma spinosa-Podisus. Arvelius albopunctatus DeG. Brochymena affinis VanD. arborea Say. obscura H.S. quadripustulata- Fabr. Carpocoris lynx Fabr. Chlorochroa lignata-Pentatoma. sayi-Pentatoma. Cimex albopunctatus—Arvelius. custator-Thyanta. lynx-Capocoris. Cosmopepla conspicillaris Dal. uhleri Mont. Dendrocoris pini Mont. Euschistus inflatus VanD. conspersus Uhl. servus Sav. Eysarcoris conspicillaris-Cosmopepla- Prinosoma podopiodes Uhl. integressa Uhl. punctiger (undetermined). Halys obscura-Brochymena. Holcostethus abbreviatus Uhl. Lioderma lignata—Pentatoma. sayi-Pentatoma. Liotropis contaminatus Uhl. humeralis Uhl. pini Mont. Menecles insertus Say. Murgantia histrionica Hahn. munda Dal.

Æthus politus-Cydnus.

Cydnus conformis Uhl.

obliquus Uhl.

politus Sign.

testudinatus Uhl.

mirabilis-Cyrtomenus.

Pentatoma claudus-Perillus binoculatus. faceta Say. inserta-Menecles. lignata Say. pallidovirens-Thyanea. rugulosa-Thyanta. sayi Stal. servus-Euschistus. Perillus binoculatus Fabr. claudus-binoculatus. splendidus Uhl. Peribilus abbreviatus Uhl. limbolarius Stal. Podisus maculiventris Say. pallens Stal. Strachia histrionica-Murgantia. munda-Murgantia. Phytidolomia faceta-Pentatoma. Thyanta antiguensis Westw. costa Stal. custator Fabr. pallidovirens Stal. rugulosa Say. tæneola Dal. Trichopepla atricornis Stal. Ziocona splendidus-Perillus.

Neottiglossa cavifrons Stal.

undata Say.

CYDNIDÆ.

teter-Cyrtomenus. Cyrtomenus mirabilis Perty. mutabilis-mirabilis. teter Spin. Geotomus parvulus Sign. Macroporus repitetus Uhl.

Pentatoma cinctus-Sehirus. piceatus Stal. Sehirus cinctus Beauv. Trichocoris conformis-Cydnus. Microporus obliquus-Cydnus. Melanæthus elongatus-Geotomus parvulus. Pangeus discrepans Uhl.

COREINA.

CAPSIDÆ.

superbus Uni. Camptobrochis nebulosus Uhl. Capsus caligneus-Cyrtocapsus. media-Lepidea. nubilis-Neurocalpus. rapidus-Calocoris. Catonia cara VanD. costata VanD. Cimex pratensis—Lygus.

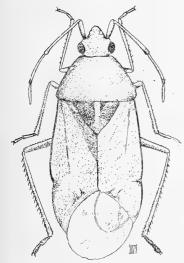


Figure 232. A Capsid.

Glosterocoris ornatus Uhl. Compsocerocoris roseus Uhl. Coquillettia insignis Uhl. Cyphopelta modesta VanD. Cyrtocapsis caligneus Stal. Ceræocoris cerachates Uhl. Dicyplus californicus Stal. Eccritotarsus elegans Uhl. Ectopiocerus anthracinus Uhl. Elidiptera fusiformis VanD. Fulvus anthocoroides Uhl. Hadromena militaris Uhl. princeps Uhl. robusta Uhl. Irbisia brachycornis Uhl. pacificus Uhl. Actinocoris lunatus-Largus. Capsus minus-Dysdercus. Cimex lunatus Largus. succinctus-Largus. Dysdercus albidiventris Stal. minus Say. obliquus H.S. peruvianus Guer. Lomatopleura cæsar Reut. Lopidea cuneata VanD. marginata Uhl. media Say. Lygus annexus Uhl. pratensis Linn. sallei Stal. convexicolle Reut. vividus Uhl. Macrotylus angularis Uhl.

regularis Uhl. tristis Uhl. verticollis Uhl. vestitus Uhl. Melinna elongata Uhl. Neurocalpus nubilis Say. Oncotylus puberus Uhl. Orthops scutellatus Uhl. Phytocoris eximius Reut. ramosus Uhl. Pœciloscytus basalis Reut.

intermedius Uhl. Rhopalostomus brachycoris-Irbisia. Stiphosoma atrata Uhl. croceipes Uhl. Systiatiotus venaticus Uhl. Telcorhinus cyaneus Uhl.

PYRRHOCORIDÆ. Largus cinctus H.S. convivus Stal. lunatus Fabr.

succinctus Linn. Lygæus peruvianus-Dysdercus. Pyrrhocoris obliquus-Dysdercus. Stenomacra marginella H.S. Agalliastes decolor Uhl. Calocoris rapidus Say.

Gonocerus apicalis-Ficania.

BERYTIDÆ.

Bervtus spinosus-Jalysus. Jalysus spinosus Say.

Acanthia scratus-Harmostes.

Neides gracilipes Stal. spinosus-Jalysus.

COREIDÆ.

Acanthocephala declivis Say. granulosus Del. Alydus apicalis—Stachylocnemis. curtulus—Tollius. quinquespinosus Say. tarsatus-Hyalymenus. Anasa obliqua Uhl. tristis DeG. Anisocelis corculus-Leptoglossa. zonatus-Leptoglossa. Archimerus lineolata-Mozena. Aufeius impressicollis Stal. Ceraleptus americanus Stal. Cimex tristis-Anasa. Chelinidea vittigera Uhl. Coreus confluens-Sagotylus. humilis Uhl. Corizus hyalinus Uhl. jacatus-scutatus. nigrosternum Sign. punctiventris Dal. scutatus Stal.

validus Uhl.

Ficania apicalis Dal.

obliqua-Anasa. Harmostes reflexulus Say. serratus Fabr. Jadera hæmatoloma- H.S. Leptocornis hæmatoloma-Jadera. trivittata-Serinetha. Leptoglessa corcula Say. zonata Dal. Lygæus hyalinus-Corizus. trivittata-Serinetha. Margus inconspicuous H.S. Metapodius granulosus-Acanthoceph. Mozena lineolata H.S. Nematopus rufoscutellatus-Paryphes. Paryphes rufoscutellatus Gray. Rhinuchus declivis-Acanthocephala. Rhopalus scutatus-Corizus. Sagotylus confluentus Say. Serinetha trivittata Say. Stachyocnemis apicalis Dal. Syromastes inconspicuus H.S. reflexus Say. Tollius curtulus Stal.

LYGÆIDÆ.

Cistalia signoreti Guer. Crophius bohemani Stal. Cymodema tabida Spin. Cymus bohemani-Crophius. Erenocorus ferus Say. Erythrischius sandrachatus-Oncopel-Geocoris pallens Stal. tristis Stal. uliginosus Say. Ischnorhynchus championi Dist. didymus-resedæ. resedæ Panz. Lygæosoma solida Uhl. Lygæus arachatus—Oncopeltus. bicrucis-Melanocoryphus. viloba-Pamera. bistriangularis Say.

costalis H.S. costalis H.S. faceatus-Melanocoryphus. gutta-Oncopeltus. kalnii Stal. leucopterus-Blissus. nebulosus-Spraglisticus. reclivatus Say. reclivatus-Oncopeltus. resedæ-Ischnorhynchus. signoreti-Cistalia. trunculentus Stal. Megalonotus sodalicus-Oncopeltus. Melanocoryphus bicrucis Say.

faceatus Say. flavomarginellus-bicrucis. Microtoma atrata Goeze.

carbonaria-atrata.

Nysius angustatus Uhl. californicus Stal. Oncopeltus Gutta H.S. reclivatus Fabr. sandrachiatus Say. Oxycaræus coriaceipennis-Rnyparochromus. Pamera bilata Say. Rhyarochromus fallax-Spharisticus nebulosus. Rhyparochromus sodalicus Uhl. Salda uliginosa—Geocoris. Spragisticus nebulosa Fall. Trapezonotus nebulosus-Spragisticus. Arphus coriaceipennis Stal. Blissus leucopterus Say. Cimex atrata-microtoma.

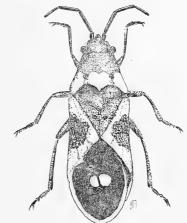
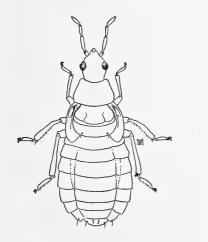


Figure 233. A Lygæid.

REDUVIINA.

ANTHOCHORIDÆ.





Anthocoris antevolens White. whitei Reut.

Piezostethus californicus Reut. Triphleps tristicolor White.

NABIDÆ.

Cimex ferus—Nabis. Coriscus ferus—Nabis. Nabis ferus Linn.

TINGITIDÆ.

Corythuca cælata Uhl. fuscigera Stal.

Piesma cinerea Say.

ARADIDÆ.

Aradus acutus Say.
affinis—lugubris.
ampliatus Uhl.
behrensi Berg.
fuscoannulatus Stal.

fuscomaculatus—fuscoannulatus. lugubris Fal. rachus—lugubris. tuberculifera Kirby.

CIMICIDÆ.

Acanthia lectularis-Cimex.

Cimex lectularis Linn.

HENICOCEPHALIDÆ.

Hymenocoris formicina Uhl.

REDUVIIDÆ.

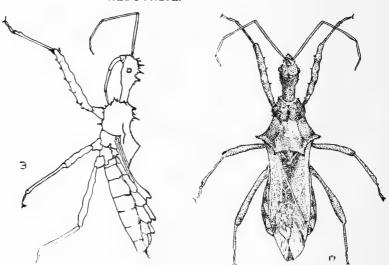


Figure 235. A Reduviid.

The species of Conorhinus and its allies are known as kissingibugs for no very good reason. All the members of this family are predaceous.

SYNOPSIS OF GENERA.

Conorhinus: front wings with quarrangular cell in middle of base of mem-

brane. Polyglampis: frond wings with a discoidal area. Sirthenia, Rasahus and Melanolestes: thorax constricted after the middle, middle tibiæ of first without spongy spot, front wings of the last black. Meccus: body pilose.

Apiometus: claws simple.

Sinea: mesopleuræ without tubercles or raised folds on hind edge. Acholla: tront tibiæ without long spines.

Zelus. Milyas: front femora shorter than hind femora.

Acholla tabida Stal.

Apiomerus crassipes Fabr. flaviventris H.S.

repletus Uhl.

Ascara tablda-Acholla.

Cimex rubrofasciata—Conorhinus.

Conorhinus protractus Uhl. rubrofasciatus DeG.

variegatus Drury

Diplodus luridus-Zelus exsanguis.

renardii-Zelus.

Meccus phyllosomus Burm.

Melanolestes abdominalis H.S.

picipes H.S.

Milyas zebra Stal.

Petalochirus biguttatus-Rasahus.

Pirates abdominalis-Melanolestes. picipes-Melanolestes.

Polyglampis pectoralis Say.

Rasahus biguttatus Say.

Reduvius carinata-Sirthenea.

crassipes—Apiomerus. pectoralis—Polyglampis.

Sinea complexa Cand.

coronata Stal.

raptoria Stal. rileyi Mont.

undulatus Uhl.

Sirthenia carinata (Fabr.) Zelus cervicallis Stal. exsanguis Stal. renardii Kel.

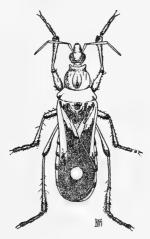


Figure 236. Rasahus.

SALDIDÆ.

Salda humilis Say. interstitialis Say. luctuosa Stal. orbiculata Uhl. pallipes Fabr. polita Uhl.

sphaceata Uhl. Scanthia humilis-Salda. interstitialis-Salda. luctuosa-Salda. pallipes-Salda.

HYDROMETRINA.

VELIIDÆ.

Hebrus sobrinus Uhi. Macrovelia hornii Uhl. Microvelia americana Uhl.

GERRIDÆ.

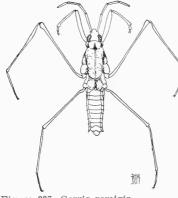


Figure 237. Gerris remigis.

Aqaurius marginata—Gerris.
remigis—Gerris.
Gerris franciscanus Stal.
arginata Say.
orbona Stal.
remigis Say.
robusta Uhl.
Hygrotrechus remigis—Gerris.
robusta—Gerris.
Limnotrechus marginata—Gerris.

NEPINA.

NEPIDÆ.

Ranatra quadridentata Stal.

GALGULIDÆ.

Galgulus variegatus Guer.

Mononyx badius H.S.

CORISIDÆ.

Corixa abdominalis Say.
bicolor Uhl.
dispersa Uhl.
fossarum Leach.
inscripta Uhl.

interruptus Say. Iævigata Uhl. serrulata Uhl. wallengreni Stal.

NOTONECTIDÆ.

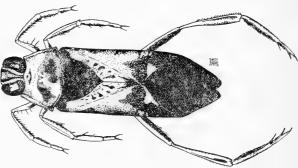


Figure 238. A Notonectid.

Notonecta insulata Kirby. shooteri Uhl.

Plea striola Fieb. undulata Say.

BELOSTOMIDÆ.

The larger Belostomidæ are commonly known as electric light bugs, being the largest insects commonly found flying about the lights. They live in the water and are predaceous.

SYNOPSIS OF GENERA.

Belostoma: first joint of proboscis short.

Zaitha. Deinostoma: metasternum with median carina. Pedinocris: membranule very short.

Belostoma annulipes H.S.
dilatatum—Deinostoma.
griseum Say.
impressum—griseum.
Dienostoma dilatatum (Say.)
Pedinocris brachonyx Mayr.

macronyx Mayr.
Zaitha fusciventris Duf.
indentata—stolli.
minor Duf.
stolli A.&S.

NAUCORIDÆ.

Ambryus pudicus Stal.

signoreti Stal.

CICADINA.

CICADIDÆ.

The harvest flies are provided with a very complex musical apparatus on the base of the abdomen of the male.

SYNOPSIS OF GENERA.

Tibicen: head narrower than thorax. Zammara: pronotum angularly dilated Platypedia: front edge of the wing bowed as much as hind edge.

Cicada.



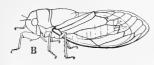


Figure 240. Harvest flies. A. Platypedia areolata. B. Tibicen rimosa.

Cicada ariolata—Platypenia.

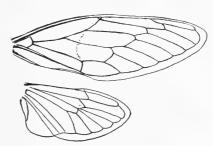


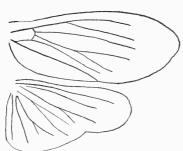
Figure 239. Venation of Cicada.

hesperia—Tibicen. montezuma Diet.

rimosa—Tibicen.
Platypedia areolata (Uhl.)
minor Uhl.
Tibicen blaisdelii Uhl.

cupreosparsa Uhl. hesperia (Uhl.) rimosa (Say.) Zammara smaragdina Walk.

FULGORIDÆ.



Cixius cultus Ball.
franciscanus Stal.
Liburna consimilis VanD.
occlusa VanD.
Megamelus bicolor Ball.
Neæthus vitripennis Stal.
Olierus aridus Ball.
Origerius rhyparus Stal.
Scolops abnormis Ball.
pallidus Uhl.
viridus Ball.
Ticidia cingulata Uhl.

Figure 241. Diagram of the main veins in a Fulgorid wing.

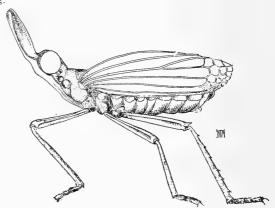


Figure 242. A Fulgorid.

MEMBRACIDÆ.

Acutalis binotatus Godi.
occidentalis Godi.
Æchmorpha californiensis Godi.
Æntianthe expansa Germ.
Campylenchia curvata Fabr.
Centrodontus atlas Godi.
Centrotis vittata—Platycotis.
Ceresa albidosparsa Stal.
bubalus Fabr.
Darnis lateralis Fabr.
Gargara atlas—Centrodontus.

Hemiptycha expansa—Antianthe.
Hoplophora tuberculata—Platycotis.
Membracis bubalus—Ceresa.
curvata—Campolenchia.
lateralis—Darnis.
sagitta—Platycotis.
Platycentris acuticornis Stal.
Platycotis asodalis Godi.
minax Godi.
sagittata Germ.
tuberculata Fairm.

víttata Fabr. Smilia vanduzii Godi. Stictccephala franciscana Stal. Stictcpelta nova Godi. Telemona ccquillettiGodi.

mexicana Stal.
reclivata Godi.
rileyi Godi.
Tropidscyta terruginipennis Godi.

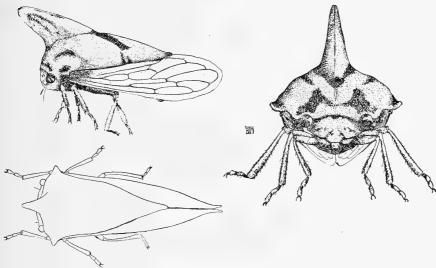


Figure 243. A Membracid.

JASSIDÆ.

The Jassidæ are strictly plant feeders but as a rule are not excessively injurious. The vine hopper, Typhlocyba comes, is the most injurious vine pest in the state (See California Bulletin 198).

SYNOPSIS OF GENERA.

Thamnotettix: occili on front edge of head which is not sharp, only one cross-vein between primary and independant veins. Jassus: without anteapical cells: Cicadula: with anterior fork of primary vein obsolete. Actinopterus: without appendix. on front wings. Scaphoideus: with outer anteapical cell narrowed to a point at apex. Phiepsius and Eutettix: bedy broad,
the former with front wings reticulate with brown.

Empoasca: without ocelli. Typhlocyba: without marginal vein in hind wing. Dicraneura: with two apical cells.

Platymetopius: similar to Thamnotettix but with two crossveins. Allygus: with two supernumerary veinlets in front wing. Deltoctphalus: front lesse than twice as long as broad.

Tettigonia: occelli on disc of vertex and jugæ not projecting. Paropulopa:

body flat. Pagaronia, Bathematophorus and Errhomellus: eyes well back on disk of vertex, the first with elytha longer than abdomen, the last with elytra much chorter. Dræculacephala: elytra reticulate at tip. Diedrocephala: vertex flat.

Uhleriella: front edge of head thin and flat. Koebelia: ocelli on face. Huleria and Cochlorinus: vertex much longer than pronotum, the former with wings much longer than body.

Agallia: occeli on face below edge of vertex. Pediopsis, Macropsis and Bythoscopus: antennæ in feeble cavities, thefirst with thorax obliquely striate, the second with thoracic margin strongly keeled. Idiocerus and Pachyopsis: head wider than base of wings, the former with appendage on membrane of wing.

Homalodisca:. Oncometopia: front longitudinally impressed. Phera: head somewhat triangular.

Actinopterus acuminatus VanD.

A ja IIa bigloviæ Bak.
californica Bak.
cinereaOsb.
inconspicuus—cinerea.
lyrata—perigrinans.
oculata VanD.
peregrinans Stal.
sanguilenta (Prov.)
uhleri VanD.

Allygus inscriptus VanD. irrorellus (Stal.) Athysanus irrorellus—Allygus.

Bathysmatophorus uhleri Bak. sanguilenta—Allygus.

Bythoscopus peregrinus Stal. Chlorita tessellata—Empoasca. Chloroneura abnormis—Dicraneura. Cicada flavescens—Empoasca.

lateralis—Oncometopia. sexnotata—Cicadula. smaragdula—Empoasca. triquetra—Homalodisca.

Cicadula nigrifrons—Deltocephalus.

sexnotata (Fal.) Cochrorinus pluto Uhl.

Deltocephalus cinerosus VanD. coquillettia—Uhleriella. fusconervis—nigrifrons.

fusconervis—nigrifrons minutus VanD. nigrifrons Forbes.

Dicraneura abnormis Walsh. cockerelli Gil. unipuncta Gil.

Diedrocephala cythura—Versuta.

versuta Say.

Dræculacephala minor—mollipes.
mollipes Say.





Figure 244. Venation of a Jassid.

reticulata Sign. Empoasca albineura Gil. flavescens Fabr. robusta Gil. smaragdula (Fal.) tessellata Fieb. Errhomenellus irroratus Ball. Eutettix pannosa Ball. subænea (VanD.) Homalodisca coagulata-triquetra. liturata Ball. triquetra Fabr. magnus Bak. robustus Uhl. Huleria quadripunctata Ball. Idiocerus alternans Fitch. amœmus VanD.

Jassus acutus-Platymetopius.

fasciaticollis-Thamnotettix. lactipennis VanD. Koebelia californica Bak. Kybos smaragdula—Empoasca. Macropsis atra Bak. californicus Bak. humilis Stal. Oncometopia lateralis Fabr. Pachyopsis robustus Uhl. Pagaronia interrupta Ball. tredecimpunctata Ball. Paropulopa interrupta Ball. Pediopsis nubila VanD. occidentalis VanD. Phera funebris (Sign.) vitripennis-Homalodisca triquo. Typhlocyba coloradensis-comes. tra. Phlepsius superbus VanD. Platymetopius acutus Say. elegans VanD. frontalis VanD. Ioricatus VanD. Proconia costalis-Oncometopia later-Scaphoideus imistus Say. scaleris VanD. Tettigonia æstuans Walk. atropunctata Sign.

cetnura Bak

circialata-atropunctata.

comes-Typhlocyba. funebris-Phera. gothica Sign. hierogliphica Say. mollipes-Drœculacephala. quadriplagiata Walk. reticulata-Dræculacephala. Thamnotettix atropunctata VanD. aureola VanD. bullata Ball. capitata VanD. coquilletti VanD. fasciaticollis (Stal.) mendica Ball. subænea-Eutettix. comes Say.



Figure 245. The vine hopper.

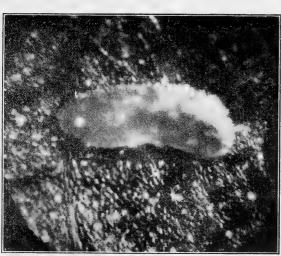


Figure 246. Egg of the vine hopper in a leaf.

flavocapitata VanD. geminata VanD. languida Ball. limbata VanD. lucida Bak. luctuosa Stal. dentata Gil.
Uhleriella coquilletti VanD.
signata Ball.
stygica Ball.
Xerophlœa peltata Uhl.
viridis Bak.

CERCOPIDÆ.

Aphrophora permutata Uhl. Ciastoptera delicata Ball. obtusa Say.

APHINA.

PSYLLIDÆ.



Aphalara puichella Cfa.

Figure 247. Venation of a Psyllid.

APHIDÆ.

Plantlice are very important pests, but as a rule quite easy to control by spraying with an oil emulsion or nicotine solution.

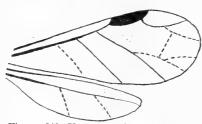


Figure 248. Venation of an Aphid.

Aphis alamedensis Clarke.

avenæ—Nectarophora.

betulæcolens—Calypterus.

brassicæ Linn.

calendulicola Mon.

ceanothi Clarke.

ceanothihirsuti Ess.

cerasi—Myzus.

cookii Ess.

cratægi Mon.
dianthi—Rhopalosiphum.
gossypi Glo.
humuli—Phorodon.
lutescensEss.
maidis Fitch.
mori Clarke.
œnotheræ Oes.
persicæniger Sm.
rosæ—Nectarophora.
rudbeckiæ Ess.
sorbi Kalt.

Calaphis caryæ—Callipterus.
Callipterus arundicolens Clarke.
betulæcolens Fitch.
caryæ Mon.
castaniæ Goetze.
hyalinus Mon.

Chaitophorus viminalis Mon. Cryptosiphum tahoense Dav. Drepanosiphum acerifolii Thom. Eriosoma querci—Schizoneura. Hyadaphis umbellulariæ Dav.
Hyalopterus arundinis Fabr.
Lachnus alnifoliæ Fitch.
californicus Ess.
Macrosiphum albifrons Ess.
lævigatæ Ess.
Myzus cerasi Fabr.
Nectarophora avenæ Fabr.
baccharidis Clarke.
californica Clarke.
citrifolii Ash.
jasmini Clarke.
lycopersici Clarke.
rhamni Clarke.
rosæ(Linn.)
sonchella Mon.

valerianiæ Clarke.

Pemphigus betæ Doane.
 fraxinidipetalæ Ess.
 populicaulis Fitch.
 radicola Es.

Phorodon humuli Fitch.
 scrophulariæ Thom.

Phylloxera vastatrix Pla.

Phopalosiphum dianthi Schr.
 violæ Es.

Schizoneura americana Ril.
 lanigera Haus.
 querci Fitch.

Siphocoryne fæniculi Pas.

Siphonophora citrifolii—Nectarophora.

ALEURODIDÆ.

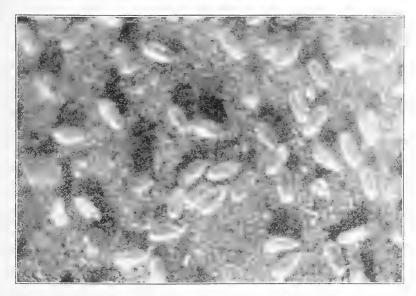


Figure 249. Eggs of the citrus white fly.

The white flies resemble scale insects in the nymph stage but both sexes are winged as adults. The most injurious species is the one attacking citrus trees, A. citri, which has only recently established itself in this state. SeeCalifornia Circulars 30 and 32.

Aleurodes acaciæ Quain. amnicola Bemis. citri R. & H. coronatus Quain.

diasemus Bemis. errans Bemis. extraniens Bemis. kellogg. Bemis. glacilaris Bemis. gelatinosa Coc.



Figure 250. Venation of an Aleurodid.

maskelli Bemis, perileucus Coc. hutcuingsi Bemis. inconspicuus Quain. prumosus Bemis. quaintancei Bemis. spirœiodes Quain.



Figure 251. Nymph of the citrus white fly.



Fiugre 252. The citrus white fly.

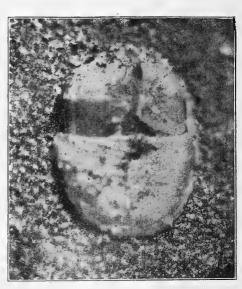


Figure 253. Exuvium of the citrus whitefly.

interrigationis Bemls. irredescens Bemis. madroni Bemis.

splendens Bemis. stanfordi Bemis tentaculatus Bemis. vittatus Quain. wellmanæ Bemis. merlini Bemis

COCCIDÆ.

This family includes some if the worst insect pests in the state. See California Bulletins 214, 222, 223 and 226.

Aclerda californica (Ehr.)
tokionis Coc.
Antonia crawii Coc.
Aonidia aurantii—Aonidiella.
Aonidiella aurantii Nach.



Figure 254. Venation of Coccidæ.

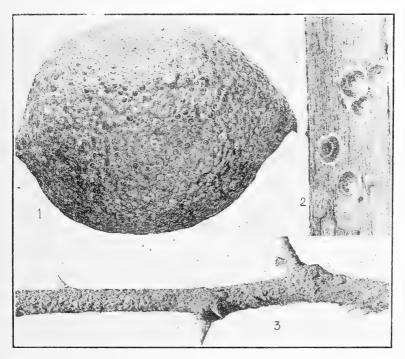
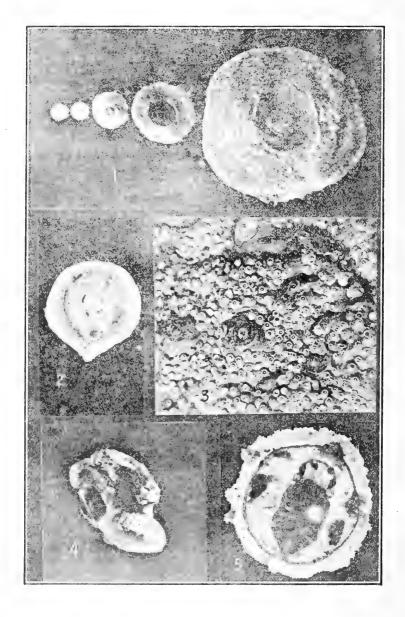


Figure 255. 1. Red scale on lemon. 2. Red scale on nightshade. 3. Red scale on twig of lemon.

Figure 256. 1 Different stages in formation of scale covering. 2 The ventral scale formed beneath the insect. 3 Old and young red scales on orange. 4 Larva of parasite, Arhelinus diaspidis, feeding on Red scale; the scale shriveled from abrorption of body contents. 5 Yellow scale containing pupa of parasite Aspidiotiphagus citrinus. (Opposite page)



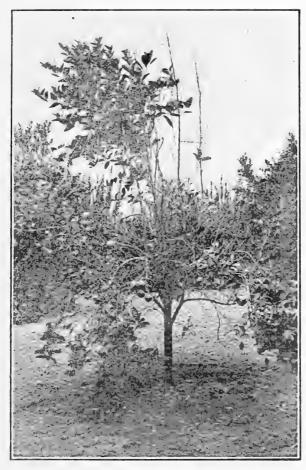


Figure 257. Tree partially killed by Red Scale.

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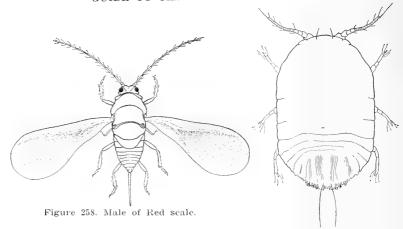


Figure 259. Motile young of Red scale.

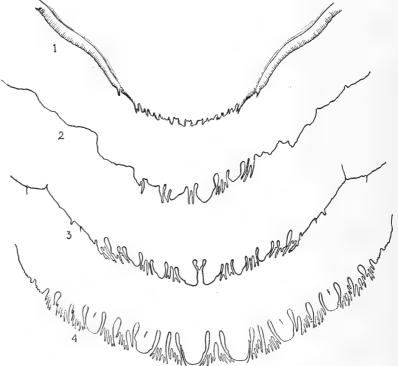


Fig re 260. 1 A cast skin after first molt. 2 A ventral cast skin, second molt. 3 Porsil (ast skin, second molt, same in Figure 265 b., which shows the ventral cast skin. 4 Characters of complete insect.

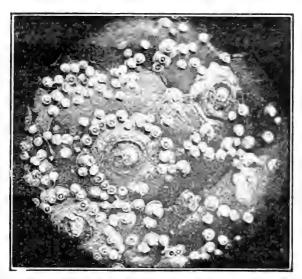


Figure 261 Red scale, mature females and young.

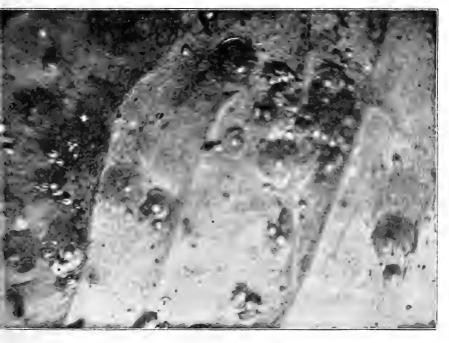


Figure 262 Red scale on leaf.



Figure 263. Ventral view of Red scale.

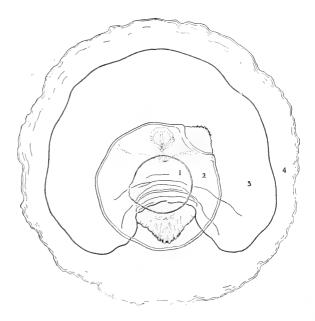


Figure 264 Showing the mature Red scale with its cast skins and scale covering. 1 First cast skin. 2 Second cast skin. 3 The insect itself. 4 The scale covering.

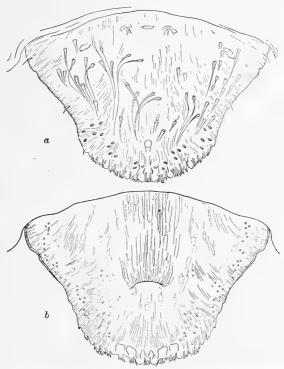


Figure 265. a. Dorsal view of pygidium of Red scale, b. Ventral cast skin of Red scale. From same insect as Figure 260, 3, which is the borsad cast skin.

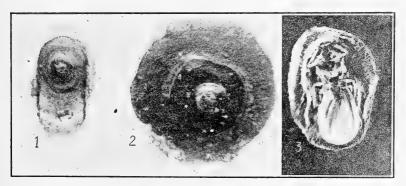


Figure 266. Scale of male. 1 Scale of female, same magnification. 3 Inverted male scale, showing winged insect beneath.

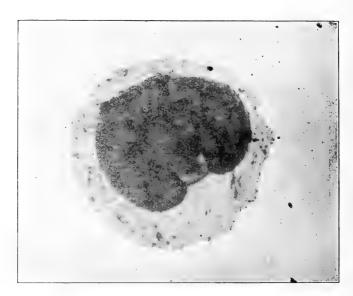


Figure 267. Red scale, the insect showing thru the transparent scale.

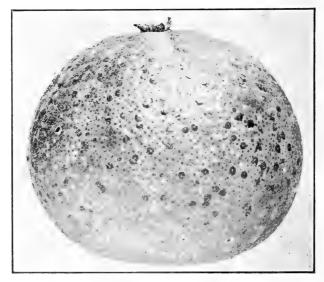


Figure 268 Yellow scale, Chrysomphalus aurantii on orange.

Aspidictus abietus (Schr.)

æscuii John.

albus—juglansregiæ.

albopunctatus—perniciosus.

californicus Col.

camelliærapax.

citrinus—Aonidiella aurantii.

conshiformis—Lepidosaphes ulmi.

coniferarum Coc.

ancylus Putn.

andromelas—perniciosus.

aurantii-Aonidiella.

bambusarum—Odontaspis.
bigeloviæ—Targionia.
buxi—Pinnaspis.
convexus—rapax.
dearnessi—Targionia.
densifloriæ Brem.
dictyospermi—Chrysomphalis
duplax—Pseudaonidia pæoniæ
echinocacti—Diaspis.
ehrhorni Col.
florenciæ Col.
furfurus—Chionaspis.
hederæ (Vall.)

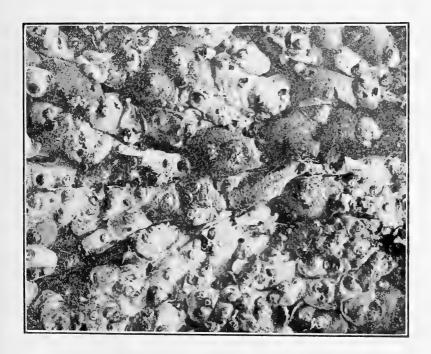


Figure 269. Oleander scale Aspidiotus hederæ.

juglansregiæ Coms. ostreæformis Curt. prosopidis—Xerophilaspis.

rapax Coms. pæoniæ—Pseudaonidia. perniciosus Coms. pinifoliæ—Chionaspis.
piricola—Epidiaspis.
rosæ—Aulacaspis.
rossi—Chrysomphalis.
salacisnigræ—Chionaspis.
shastæ—coniferum.
tenebricosus—Chrysomphalus.

cistudiformis Coms.
floridensis Coms.
irregularis Coc.
irregularis Coc.
rubens Mask.
Ceorputo ambigua Full.
bahiæ (Ehr.)

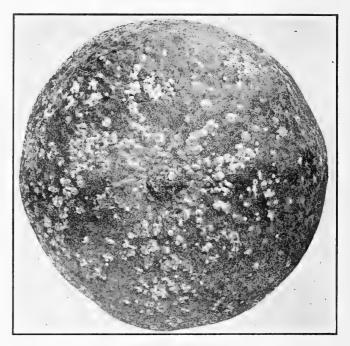


Figure 270. Orange infested with Greedy scale Aspidiotus rapax.

yulupæ Brem.

Asterolecanium crawii (Coc.)
pentagona (Targ.)
rosæ (Bouche.)
variolosum (Ratz.)

Asterolechanium variolosum Ratz.

Aulacaspis crawii (Coc.)
Blastothrix yuccæ—Ceroputo.
Cerococcus ehrhorni Coc.
quercus Coms.
Ceroplastes ceriferus (And.)
cerripediformis Coms.

cænothi—yuccæ.
yuccæ (Ccq.)
Chætococcus bambusæ (Mask.)
Chermes hederæ—Aspidiotus.
oleæ—Saisettia.
Chionaspis aspidistræ—Hemichionaspis.
assimilis Mask.
aucubæ—Phenacaspis.
biclavis—Howardia.
citri Coms.
chinensis—Phenacaspis.

cockerelli—Phenacaspis.
difficilis Coc.
euonymi Coms.
furfura (Fitch.)
latissima—Phenacaspis.
ortholobis Coms.
pinifoliæ (Fitch.)
quercus Coms.
salacis nigræ Walsh.
sassceri C.& R.
spartinæ Coms.
striata News.
wisteriæ Cool.
persicæ—Lecanium.
pollini—Pollinia.

aurantii—Aonidiella.
citrinus—Aonidiella aurantii.
dictiospermi (Morg.)
rossi (Mask.)
tenebricosus (Coms.)
Coccus abietus—Aspidiotus.
adonidum—Pseudococcus.
aonidum—Chrysomphalus.
beckii—Lepidosaphes.
blanchardii—Orthesia.
bromehæ—Diaspis.
ceriferus—Ceroplastes.
crawii—Pseudococcus.
destructor—Pseudococcus.
destructor—Pseudococcus cacti.

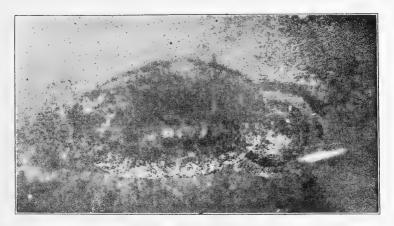


Figure 271. Red and soft brown scale.

stellifera-Vinsonia. ulmi Lepidosaphes. variolosum-Asterolecanium. ulmi-Lepidosaphes. vitis-Pulvinaria. ziziphus-Parlatoria. Conchaspis angæci Coc. hibisci-angæci. Dactylopius affinis-Pseudococcus. andersoni-Pseudococcus. aurilanatus-Pseudococcus. azaleæ--Pseudococcus. calceolariæ—Pseudococcus. citri-Pseudococcus. coccus Costa. Chrysomphalus aonidum (Linn.)

dudlei—Pseudococcus.
ephedræ—Pseudococcus.
erigoni—Erium.
gloveri—Lepidosaphes.
hesperidum Linn.
hymenocleæ—Pseudococcus.
icteryoides—Erium.
longispinus—Pseudococcus adonidum.
maritimns—Pseudococcus.
pseudonipæ—Pseudococcus.
quercus—Pseudococcus.
ryani—Pseudococcus.
sequoiæ—Pseudococcus.
sequoiæ—Pseudococcus.



Figure 272. Soft brown scale on orange twig.

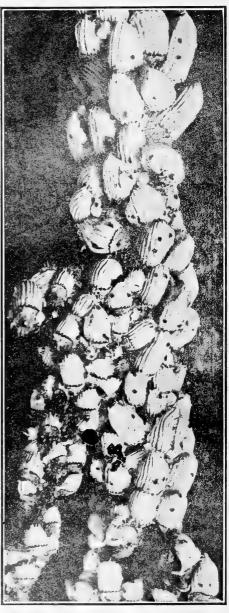


Figure 273. Cottony cushion scale on or ange twig. $\,$

solani—Pseudococcus.

Diaspis boisduvalii Sign.
bromeliæ (Kern.)
cacti—echinocacti.
carulei Targ.
cattleyæ—(Coc.)
crawii—Aulacaspis.
echinocacti (Bouche.)
fiorinæ—Fiorinia.
pentagona—Aulacaspis.
rosæ—Aulacaspis.
Dorthesia citri—Pseudococcus.
Epidiaspis pyricola (Del.)

Eriococcus adenostomæ Ehr.
artemisiæ Kuw.
auricariæ Mask.
bahiæ Ehr.
catalinæ Ehr.
howardii Ehr.
neglactus Coc.
palmeri Coc.

Erium erigoni (Ehr.) lichtensioides (Coc.)

Eucalymnatus perforatus—tessellatus. tessellatus (Sign.)

Eulecanium adenostomæ—Lecanium. armeniacum—Lecanium corni. cerasorum (Coc.) crawii—Lecanium corni.

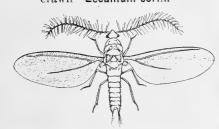


Figure 275. Male of Cottony cushion scale.

Ischnaspis longirostris (Sign.)
Kermes austini Ehr.
cockerelli Ehr.
galliformis Ril.
nigropunctatus E.&C.
rattani Ehr.
Lecaniodiaspis pubescens Ehr.
rufescens (Coq.)
Lecanium adenostomæ Kuw.
areniacum—corni.
cerasorum—Eulecanium.

kermoides—Lecanium quercifex.
magnoliarum—Lecanium persicæ.
persicæ—Lecanium.
pruinosum—Lecanium.
pubescens—Lecanium.
quercitronis—Lecanium quercifex.

Exærotopus caricis Ehr.
Fiorina fiorinæ (Targ.)
Gossyparia spuria (Mod.)
Hemichionaspis aspidistræ Sign.
Howardia biclavis (Coms.)
Icerya purchasi Mask.

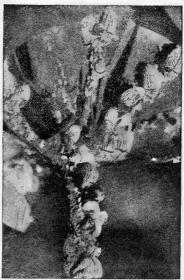


Figure 274. The cottony cushion scale.

corni Bouche.
crawii—corni.
hemisphericum—Saisettia.
persicæ Fabr.
pruinosum Coq.
pubescens Ehr.
quercifex Fitch.
quercitronis—quercifex.
tessellatus—Eucalymnatus.
epidosaphes beckii (Newm.)

Lepidosaphes beckii (Newm.)





Figure 277, Purple scale on orange leaf enlarged.

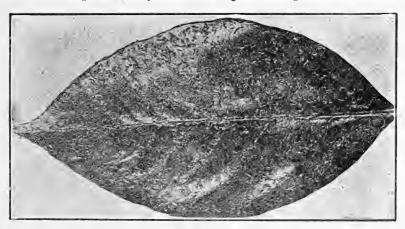


Figure 278. Purple scale on orange leaf

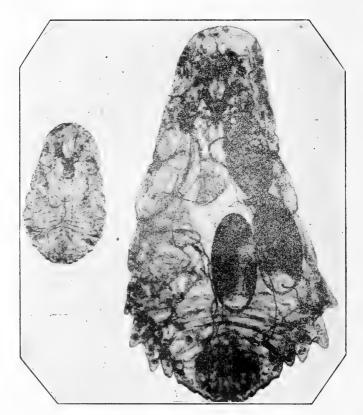


Figure 279. Purple scale after first molt, and mature female.



Figure 280. Pygidium of adult female Purple scale.

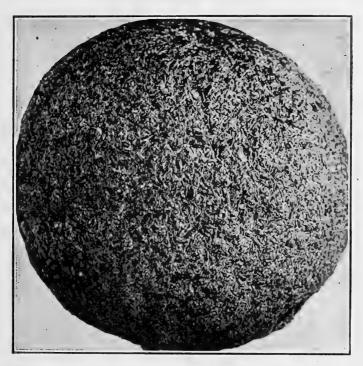
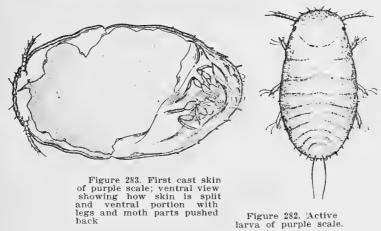


Figure 281 Orange incrusted with Purple scale.



concolor (Coc.) gloveri (, ack. newsteadi—(Sulc.) ulmi. (Linn.) Leucaspis cupressi Col. japonicus Coc. kellogi Col. Mytilaspis beckii-Lepidosaphes. concolor-Lepidosaphes. longirostris-Ischnaspis. newsteadi-Lepidosaphes. pomorum-Lepidosaphes ulmi. ulmi-Lepidosaphes. Nidularia californica-Aclerda. Odontaspis bambusarum Coc. graminis Brem. Orthesia californica Ehr. insignis Doug. Palæococcus bridwelli Col. Parlatoria blanchardi (Targ.) pergandii Coc. victrix-blanchardii. ziziphus Lucas. Pnænacoccus artemisiæ Ehr. bahiæ-Ceroputo. colmani Ehr. kuwanæ Col. ramonæ Ess. simplex King. stachylos Ehr. Phænacaspis artimesiæ Ehr. aucubæ (Cool.)

chinensis Coc.
cockerelli (Cool.)
latissima (Coc.)
Phenicoccus marlatii Coc.
Physokermes concolor Col.
insignicola Craw.



Figure 284. Pine scale, Physokermes ins ignicola.

taxifolia Col.
Pinnaspis buxi (Bouche.)
Pollinia pollini (Costa.)
Prosapophora rufescens—Lecaniodiaspis.
pæoniæ (Coc.)

Pseudococcus. 1813. citri. 1869. longispinis anal appendages as long as body. 1889. crawii: citri—antennal joint 2 longer than 7. ryani: crawii—antennal joint 1 longer than 5. aurilanatus: band of yellow wax on back. 1890.ephedræ: crawii—fifth antennal joint four times as long as broad. 1891. iceryoides: with dense ventral cottony cushion. 1898. azaleæ: crawii—posterior lateral filiments nearly as long as anal. 1900. quercus: crawii—body greenish brown. maritimus: crawii et al anal filiments balf as long as body. 1901. sequoiæ: citri—antennal joint 4 as long as 6. 1902. salinas: crawii—cephalic filiments present. 1903. dudlei: crawii et al—antennal joint 1 longer than 3.andersonni: crawii et al—antennal joint 2 longer than 4.

Pseudaonidia adonidum (Linn.) affinis (Mask.) agrifoliæ Es. andersoni (Col.) artemisiæ Es.

aurilanatus (Mask.) azaliæ (Tin.) calceolariæ (Mask.) citri (Risso.)

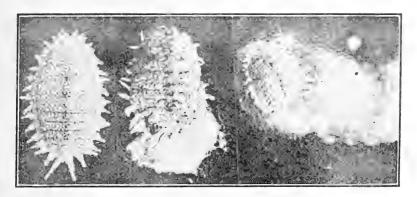


Figure 285. Citrus mealy bug Pseudococcus citri. The two figures on the right show the development of the cottony mass in which the eggs are deposited.



Figure 286 Mealy bug on lemons.

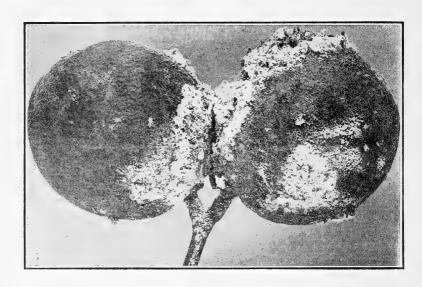


Figure 287. Mealy bug on oranges.

crawii (Coq.)
cupressi (Col.)
dudlei Col.)
ephedræ (Coq.)
hymenocleæ (Coc.)
iceryoides (Mask.)
junipari Ehr.
longipennis—adonidum.
maritimus (Ehr.)
obscurus Es.

quercus (Ehr.)
ryani (Coq.)
salinus (Coc.)
sequoiæ (Col.)
solani (Coc.)
yuccæ—Ceroputa.
Pseudolecanium distichlium—Sphærococcus.

pseudonipæ (Coc.)

Pulvinaria. Antennal formulæ: 1758 vitis 3 4 5 2 8 1 (6 7), (3 5) (2 4) (6 7) 8 1. 1870 flocifera 3 2 4 5 8 (1 6 7). 1873 camelicola 3 2 8 (1 4 5) (6 7). 1892 psidii (3 8) 1 (4 5) (6 7). 1983 bigloviæ (2 3) 4 (5 8) (6 7). 1896 amygdali 3 4 8 2 5 (6 7) 1898 rhois 3 (1 2 4) 5 8 6 7. 1901 ehrhorni 3 (4 5) 1 (8 6 7)

1906 plucheæ 3 (2 4) 1 5 8 6 7. Pulvinaria amygdali Coc.

bigloviæ Coc. camelicola Sign. ehrhorni King. innumerabilis—vitis. villosa Ehr.
Ripersiella kelloggi E.& C.
plucheæ Ehr.
psidii Mask.
rhois Ehr.
vitis (Linn.)

Ripersia festucæ Kuw. vitis (Linn.)

Saisettia, 1782. oleæ, 1867. hemisphæricum: dorsal pits not in polygonal areas.

Saissetia hemisphericum (Targ.)



Figure 289. Hemispherical scale on leaf of orange.

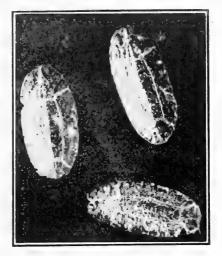


Figure 288. Male puparia of Hemispherical scale.

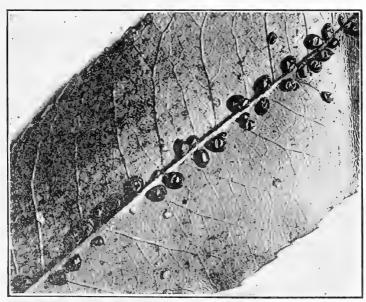


Figure 290. Hemispherical scale, Saisse-tia hemisphærica, on leaf of Christmas berry.



Figure 291. Hemispherical scale on $twig\ of\ orange.$ oleæ Bern.



Figure 293 Black scale on lemon.



Figure 492. Black scale on Abutilon.

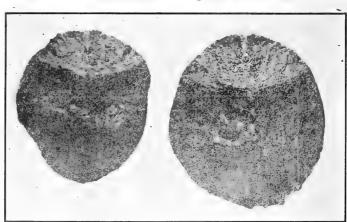


Figure 294. Mature Black scales.

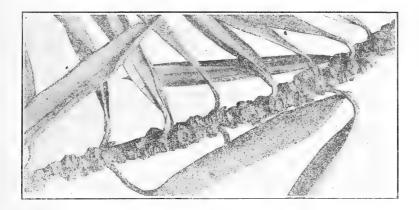


Figure 295. Black scale on olive.



Figure 296. Black scale on twig producing smut on leaves below.

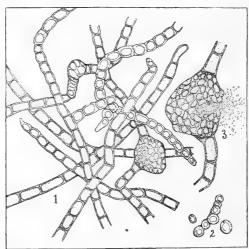


Figure 297. The sooty mold fungus. Much enlarged, 1 Mycelium, 2 Conidia, 3 Pycnidia with immature spores.

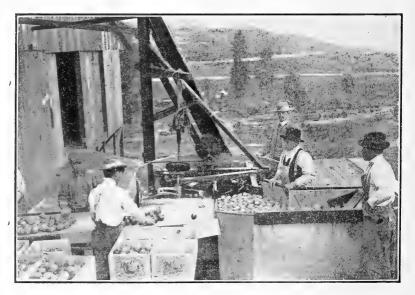
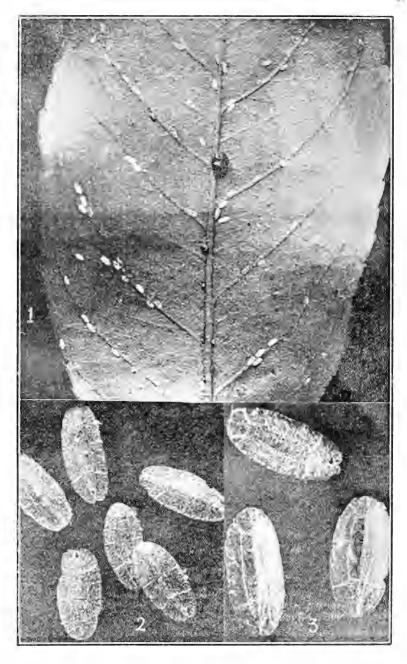


Figure 299 Washing oranges to remove sooty mo'd fungus which grows in the so-called honeydew from the Black scale.

Figure 300. 1 Male of Black scale. 2 Same enlarged, 3 Puparia of Hemisphærical scale. Same magnification as 2. (Opposite page.)



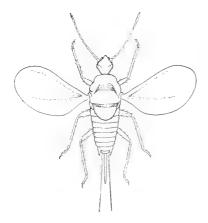
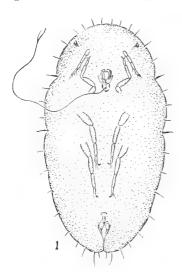
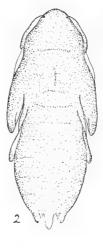


Figure 302 Male of Black scale.



Figure 305. Black scale on barbary.





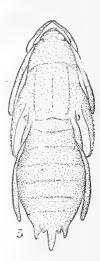


Figure 303 Development of the male of the Black scale. 1 Second stage 2 Propupa. 3 Pupa.

Figure 304. 1 Different stages of Black scale. 2 Young Black scale shortly after settling. 3 Eggs of Rhizobius ventralis under Black scale. 4 Hemispherical scale on left and Black of same size on right. 5 Inverted Black scale with 50 eggs of Scutellista. (Opposite page.)

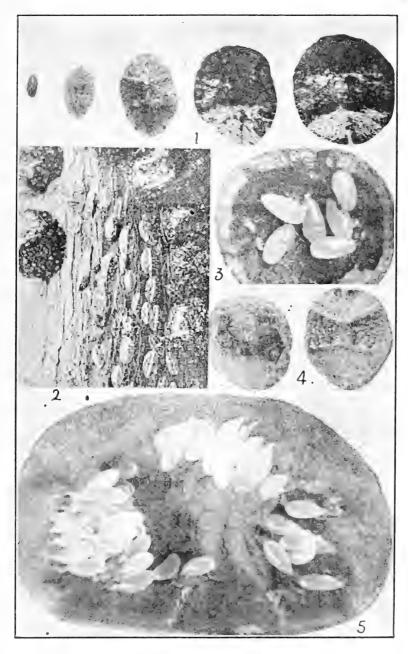






Figure 306. Lecanium quercifex on oak. Figure 301. Black scale on orange.

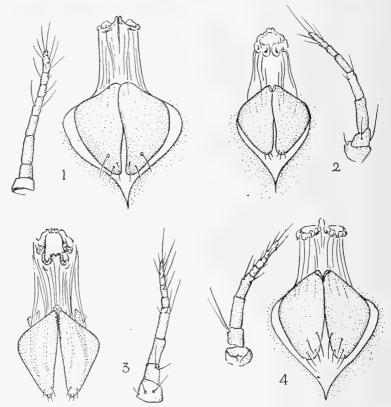
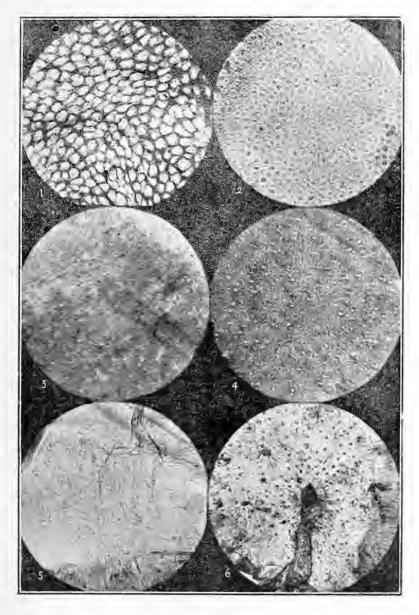


Figure 306. Antennæ and anal lobes. 1 Saissetia oleæ. 2 Lecanium pruinosum. 3 Coccus hesperidum. 4 Lecanium corni.

Figure 307 Photomicrographs of derm pores. 1 Saissetia olex. 2 Saissetia hemisphærica. 3 Lecanium corni. 4 Lecanium. 4 Lecanium pruinosum. 5 Lecanium sp. on Heteromeles. 6 Coccus hesperidum. (Opposite page)



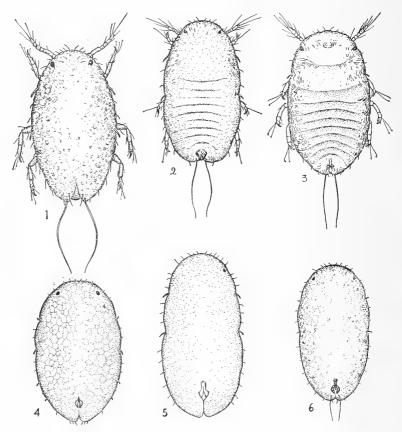


Figure 308. First and second stages of unarmored scale insects. 1 and 4, Saissetia oleæ. 2 and 5 Coccus hesperidum. 3 and 6 Lecanium corni.

Sphærococcus bambusæ-Chætococcus. Vinsonia stellifera (Westw.) distichlium (Kuw.) Targionia bigeloviæ (Coc.) dearnessi (Coc.)

Xerophilaspis prosopidis (Ccc.) Aylococcus macrocarpæ Col. quercus Ehr.

THRIPSINA.

The thrips have been largely neglected by entomologists until within the last few years. The damage done by the pear thrips first attracted great attention and later the orange thrips and numerous other species have. been carefully studied. The most troublesome species are the pear thrips, Physothrips pyri, the onion thrips, Thrips tabaci, the greenhouse thrips Heliothrips hæmorrhoidalis, the orange thrips Physothrips citri, and the grass thrips Frankliniella tritici. A number of species are known to feed on other insects.

SYNOPSIS OF GENERA.

Sercothrips: adbomen with a silky lustre due to covering of extremely fine hairs.

Physothrips: abdomen with saw-like ovipositor, and antennæ eight joinetd Heliothrips and Echinothrips: body reticulate, the latter with prothorax as long as head. Limothrips: tibiæ with a pair of stout spines near the tip. Odontothrips and Franklinella: with prominent spines at front angles of prothorax, the latter with tooth at end of front tibiæ.

Trichothrips: abdomen without saw-like ovipositor and head about as wide as long. Haplothrips: antennæ seven jointed.

Thrips: antennæ seven jointed. Parenothrips: body reticulate.

Æolothrips: antennæ nine jointed. Orothrips: wings with dark cross bands. Erythrothrips: wings with longitudinal bands. Ankothrips: last four abdominal segments not closely united.

Liothrips. Megalothrips: head more than twice as long as wide. Hoplothrips: with tooth at inner side of front femora. Cephalothrips and Cryptothrips: wings rudimentary, the latter with spine bearing warts on cheeks. Phlæothrips: cheeks with spine bearing warts.

Synopsis: - Moulton, U. S. Ent. Tech. Bulletin 21, Jones, ibid. 23.

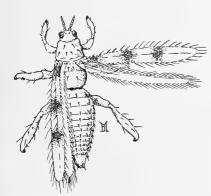


Figure 310. Scolothrips sexmaculatus Feeds on Red spider.

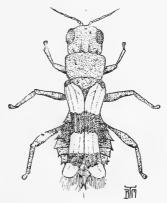


Figure 309 Heliothrips fasciatus.

ÆOLIOTHRIPIDÆ.

Æolothrips fasciatus Linn, nasturtii Jones.

kuwanaii Moul. Iongiceps Cra. Ankothrips robusta Cra. Calothrips woodworthii—Heliothrips fasciatus.

robustus-kuwanali.

Erythrothrips arizoniæ Moul. Orothrips kelloggi Moul. yosemite-kelloggi.

THRIPIDÆ.

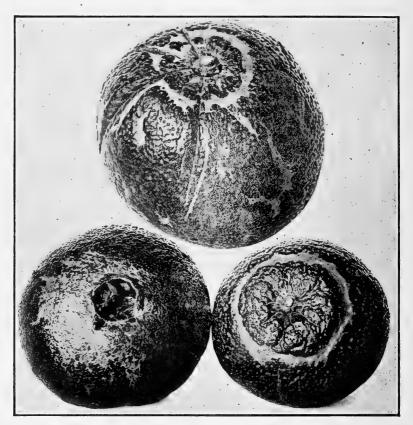


Figure 311. Work of thrips Euthrips citri on fruit.

Anaphothrips albus-Euthrips. striatus—Euthrips. tricolor—Euthrips. zeæ-Euthrips. Anthothrips flavipes-Haplothrips. niger—Haplothrips.
Aptinothrips rufus Gm. connatticornis-rufus.

Echinothrips mexicanus Moul. Euthrips albus-Physothrips. albus (Jones). californicus-Frankliniella tritici. californicus-Odontothrips. ulicis. citri-Physothrips.

costalis-Physothrips. ehrhorni-Physothrips. helianthi-Frankliniella longirostrum—Physothrips. minutus-Frankliniella. occidentalis-Frankliniella. orchidii-Physothrips.

parvus-Physothrips. pyri-Physothrips. striatus (Osb.) tricolor (Moul.) tritici-Frankliniella. ulicis-Odontothrips. zeæ (Moul.)

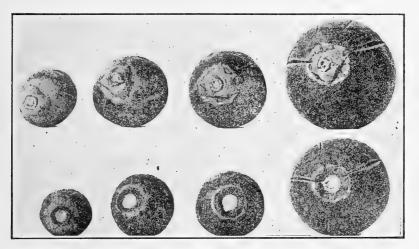


Figure 312. Characteristic rings at stem end of small oranges made by thrips.

Physothrips citri. Frankliniella 1855 tritici. (11) 1895 occidentalis: pale lemon yellow. 1907 minutus: postocular spines wanting. 1911 helianthi: tritici—not shaded with orange.

Frankliniella helianthi (Moul.) minutus (Moul.) occidentalis (Perg.)

tritici (Fitch). Haplothrips flavipes (Jone). niger (Osb.)

Heliothrips 1833 hæmorrhoidalis. 1895 fasciatus: hind and middle tiblæ brown

Heliothrips fasciapennis Hinds. fasciatus Perg.

hæmorrhoidalis Bouche. Limothrips setariæ Jones.

Physothrips 1904 pyri. (07) 1907 orchidii: head distinctly wider than long. ehrhorni: (y2) pyri—eyes not pilose. 1909 citri: (11) orchidii—last two antennal segments together only about half as long as the sixth. 1901 parvus: citri-wings shaded brown. albus: (12) citri-color white. 1912 costalis: albus-ring vein conspicuous. longirostrum: ehrhorni-postocular spines wanting.

Physothrips albus (Moul.) citri (Moul.) costalis (Jones). ehrhornii (Moul.

longirostrum (Jones), orchidii (Moul.) parvus (Moul) pyri (Dan.

Odontothrips ulicis (Hal) Sericothrips albus Jones. apteris Dan. moultoni Jones. reticulatus Moul. stanfordii Moul. variabilis Bea. Thrips bremneri Moul femoralis-miscrocephalus.

hæmorrhoidalis-Heliothrips. madronii Moul. magnus Moul. miscrocephalus Jones. (ms.) tabaci Lind. tritici—Euthrips. ul'eis—Euthrips. Parenothrips dracænæ Heeg.

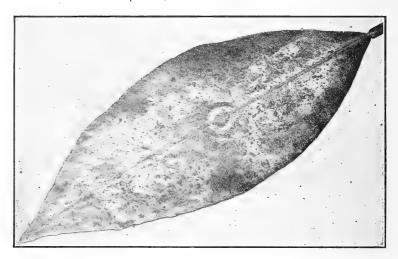


Figure 313. The work of Heliothrips hæmorrhoidalis on orange leaf.

PHLŒOTHRIPIDÆ.

Trichothrips dens Moul. dumosa-ilex. ruber Moul. femoralis Moul. ilex Moul.

Hoplothrips corticis Serv. Acanthothrips doanei — Hoplothrips corticis.

Cryptothrips californicus-Leptothrips Leptothrips aspersus Hinds. aspersus. salacis Jones.

Cenhalethrips errans Moul, Phlocothrips armiger Jones. jennei Jones. Liothrips fasciculatus Cra. stenoceps-fasciculatus.

mcconnellii-Leptothrips asper-Megalothrips hesperus Moul.

russelli Mor.

PEDICULINA.

PEDICULIDÆ.

Hematopinus suis (Linn.) Pediculus capitis DeG. suis Hematopinus.

vestimenti Leach. Phthirius inguinalis Leach.

ORTHOPTERA.

The Orthoptera is the first group to leave abundant fossil remains and for this reason has bee considered by some entomologists as the ancestral group of winged insects. They are the first group of insects to become hard bodied which probably explains in part the geological record. The Order was grouped with the Hemiptera by Linnæus and has been combined with the Pseudoneuroptera by many German entomologists. On the other hand it

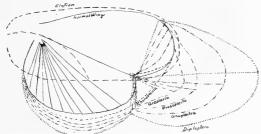


Figure 314. Diagram showing a series of cockroach wings with fold areas approaching the structure found in the wing of an earwig.

has not infrequently been split into two orders and occasionally into several. The peculiar wing structure in the earwigs has occasioned their separation as a separate order tho it has been shown that the cockroaches show an approach and and is doubtless the group from which they arose. The three families of jumping Orthoptera are the more modern branch of the order, the other families fall into two series, the cockroaches and earwigs forming a group distinct from all other Orthoptera, and perhaps representing a different line of descent.

SYNOPSIS OF FAMILIES.

Acrididæ: hind legs enlarged for leaping and antennæ shorter than body.

Locustidæ: similar, but antennæ long. Gryllidæ: feet three-jointed. Blattidæ: body flattened. Forficulidæ: with forceps at end of body.

Phasmidæ. Mantidæ: front legs greatly enlarged.

ACRIDIDÆ.

The migratory members of this family have been known as locusts but the more common name of these insects when not migrating is grass hoppers. Locusts probably rank first of all insect pests.



Figure 315. Diagram showing the principle veins in the wing of Acrididæ.

SYNOPSIS OF GENERA.

Melanoplus: prothorax spined beneath and metasternal lobes as broad as long. Dracotettix: apical spurs on both sides of hind tibiæ. Parapomala, Leptysma and Arnilia: face very oblique, the first with hind tibiæ expanded

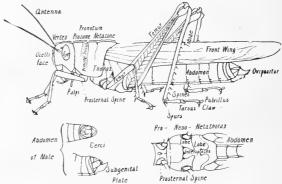


Figure 316. Structures used in the classification of grasshoppers.

apically and the second with head as long as pronotum. Dactylotum: less than nine spines on outer margin of hind tibiæ. Bradynotus: wingless. Pœcilotettix: no median carina. Œdaleonotus: cerinæ interrupted between sulci. Hesperotettix: crest equal on prozona and metazona. Æoloplus: pronotum narrowest in front of principal sulcus.

Triberotropus: pronotal carinæ evident, twice intersected, the principal sulcus distinct on sides. Aconia and Heliastes: crest deeply interrupted between sulci, the latter with middle independent vein feeble or wanting.

Hadrotettix: pronotum not crested in front. Daratmena: sides of metazona narrowed beneath. Mestobregma: lateral canthi bending at principal sulcus or absent in front. Circotettix: posterior veins of hind wings swollen in the middle. Conozoa: crest as high as on prozona.

Hippiscus: prosternum rough.
Schistocerca: prosternum spined.

Orphulella: face and vertex angled or the latter with distinct foveæ. Gymnes, Bootetix and Ligurotettix: top of head bent up from pronotum, the last Opeia, Horisodotes and Napaia: antennæ triquetrus, the first with inner spurs of hind tibiæ unequal, the last with front wings shorter than abdomen two very distinctly so, in the second forming an acute angle with face. Plectrotettix, Brunneria, Stenobothris, Eupnigodes, Aulocara, Psæssa and Stirapueura: temporæ visible from above, the first with face and vertex not meeting in an angle as seen from side, the second and third with temporæ more than twice as long as broad, the former with prozona longer than metazona, the fourth with pronotum shorter than head, the fifth with prozona longer than metazona and the last with temporæ visible throughout the length. Œonomus and Amphitornus: with a distinct median carina on prothorax. Alphia: tibiæ red.

Telmotettix: pronotum extending to tip of abdomen. Paratettix: vertex not narrowed anteriorly. Tettix and Merotettix: vertex advanced beyond eyes, the latter with vertex wider than an eye.

Arphia. Cortophaga, Chimarocephala and Encoptolophus: interspace between metasternal foramina longer than broad, the first with hind wings bright colored, the second with middle independent vein midway between others and the third with head compressed. Camnula, Agymnastus and Leprus, principal sulcus feeble or wanting on sides of pronotum, the first with pronotal carina conspicuous, the second with wings shorter than abdomen. Lactista: costal margin of wing thickened nearly to tip. Scirtetica, Microtus and Spharagemon: with band on middle of wings, the first with crest feebly intersected, the last with intercalary vein.

borckii-Melanoplus. differentialis-Melanoplus. femurrubrum-Melanoplus. granulatus.-Tettix. shoshone-Schistocerca. vaga-Schistocerca. Æolophus arcuatus-chenopodii. californicus Scud. chenipodii (Brun.) Agynastus ingens (Scud.) Alpha cinera (Brun.) Amphitomus ornatus McN. Antonia integra Scud. Arnilia mexicana (Saus.) Arphia behrensi Saus. hesperiphila Rehn.

Acridium alutacea-Schistocerca.

ramona Rehn. sulphurea (Fabr.) Aulocara ellioti Thom. Bootettix argentatus Brun. Bradynotus obesa (Thom.) referata Scud. satur Scud. Bruneria shastana Scud. Caloptenus atlantis-Melanoplus. collaris—Œdalionotus enigma. femoratus-Melanoplus. femurrubrum-Melanoplus. spretus-Melanoplus. viridis—Hesperotettix. Camnula pellucida (Scud.) Chimarocephala behrensi Saus. brevipennis-Chortophaga.

pacifica (Thom.)
Chortophaga brevipennis (Scud.)
thallassinus Saus.
Circotettix maculatus Scud.
occidentalis (Brun.)
shastanus Brun.
verruculatus (Kirby.)
Conozoa behrensi Saus.

Encoptolophus pallidus Brun.
sordidus—pallidus.
Eupnigodes megacephala McN.
Gomphocerus pelidna—Orphulella.
shastana—Brunneria.
Gryllus carolina—Dissosteira.
sulfurea—Arphia.
Gymnes punctatus Scud.

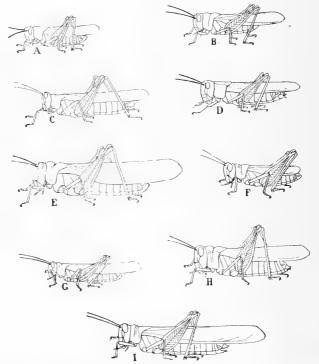


Figure 317. Common California grasshoppers. A Chimarocephala pacifica, B. Arphia sulphurea. C. Conozoa behrensi. D.Camnula pellucida. E. Dissosteira spurcata. F. Hadrotettix mundus. G. Lactista gibbosus. H. Circotettix shastanus. I. Trimerotropis pseudofasciatus.

koebelei Brun.
rebellis—Trimerotropis.
sulcifrons (Scud.)
wallula (Scud.
Dactylotum variegatum (Scud.)
Derotmena delicatulum Scud.
saussureanum Scud.
Dissosteira monstrosus Brun.
plutonius Brun.

Hadrotettix mundus Scud.
Heliastus aridus (Brun.)
californicus (Thom.)
minimus (Scud.)
Hesperotettix festivus Scud.
pacificus Brun.
pratensis Scud.
viridis (Thom.)
Hippiscus aurilegulus Scud.

californicus Scud. calthulus (Saus.) lateritius (Saus.) marmoratus Scud. neglectus (Thom.) paradalis (Saus.)





Figure 318. Common California grasshoppers. A. Bradynotus satur. B Œdaleonotus enigma.

stigmosus Scud.
zapotecus (Saus.)
Horresidotus cinereus Scud.
Lactista gibbosa Saus.
Leprus glaucipennis Scud.
ingens—Agymnastus.
intermedius Saus.
Leptysma marginicollis Serv.
Ligurotettix coquilletti McN.
Locusta verruculata—Circotettix.





Figure 319. Common California grasshopppers. A. Telmatettix aztecum. B. Stenobothris Oregonensis.

Mastobregma hyalinum Scud. kiowa (Thom.) rosaceum Scud. Melanoplus ablutus Scud. affinis—devastator. angelicus Scud.
ascensus Scud.
ater Scud.
atlanis (Riley.)
blandus Scud.
borckii (Stal.)
devastator Scud.
cinereus Scud.
consanguineus Scud.
dealbatus Scud.



Figure. 320 Melanoplus devastator, nymph.

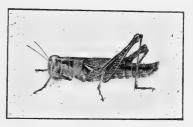


Figure 321. A short winged adult Melanoplus.

differentialis (Uhl.) diminutus Scud. femoratus (Burm.)

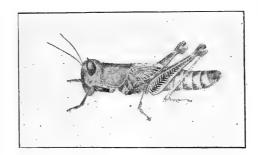


Figure 322. Melanoplus differentialis, nymph.

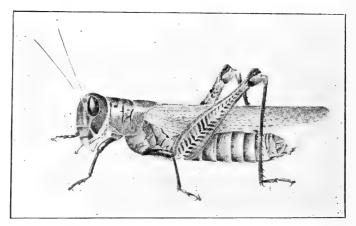


Figure 323. Melanoplus differentialis.

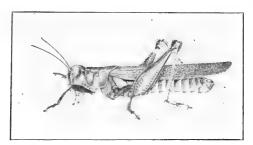


Figure 324. Melanoplus uniformis.

femurrubrum (DeG. flavescens Scud. fuscipes McN. gracilipes McN. lepidus Scud. marginatus (Scud.) missionum Scud. nanus Scud. olivaceus Scud. pacificus (Scud.) packardii Scud. phætaliotiformis Scud. pinctus Scud. rileanus McN. similis Scud. spretus (Uhl.) tenuipes McN. uniformis Scud. varicus Scud. virgatus McN.

Menotettix pristinum Morse.
Morsea californica Scud.
Microtus nubila Scud.
Napaia gracilis McN.
Ochrilidea cinerea—Alpha.
Œdaleonotus enigma (Scud.)



Figure 325. The valley grasshopper, Œdaleonotus enigma.

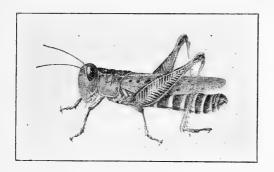


Figure 326. The valley grasshopper, Œdaleonotus enigma.

pellucida—Camnula.

Œdocara strangulata—Aulocara elliotti.

Œonomus altus Scud.

OPeia testacea Scud.

Opomala marginicoilis—Leptysma.

mexicana—Arnilia.

Orphula tepanica—Orphulella affinis.

Œdipoda cincta—Trimerotropis.

kiowa—Mestobregma.
neglectus—Hippiscus.
obliterata—Dissosteira spurcata.
occidentalis—Circotettix.
paradalinus—Hippiscus.
Orphulella affinis Scud.
compta Scud.
pelidna (Burm.)
Paratettix hesperinus—Talmotettix.



Figure 327. The use of the hopper dozer for killing grasshoppers.



Figure 238. Prepairing to use fire against grasshoppers.

mexicanus (Saus.) morsea Han. toltecus Saus. Paropomala calamus Scud. virgatus Scud. Pezotettix atlanis-Melanoplus. borckii--Melanoplus. chenopodii-Æolophus. collaris-Œdaleonotus enigma. enigma-CEdaleonotus. jucundus-Œdalionotus enigma. marginatus-Melanoplus. obesa-Bradynotus. pacificus-Melanoplus. variegatum—Dactylotum. Plectrotettix patriæ Scud. Pnigodes megacephala—Eupnigodes. Podisma borkii-Melanoplus. Pœcilotettix coccinatus Scud. Psinidia sulcifrons-Conozoa. wallula-Conozoa. Psolæssa maculipennis Scud. texana Scud. hyalina McN. juliana Scud. koebelei Brun. Scirtettix occidentalis Brun. Scyllina delicatula—Stiraplura pusilla. Schistocerca alutacea (Harr.) carinata Ccud. shoshone (Thom.) vaga (Scud.) venusta Scud. Spharagemon venustum (Stal.) Stauronotus elliotti-Aulocara. Stenobothris oregonensis Scud. Stichippus californicus—Hippiscus. Stirapleura decussata Scud.

delicatula—pusilla. pusilla Ccud.

Telmotettix aztecus Saus.

aridus Han. hesperinus Morse. Tettix aztecus-Telmotettix. granulatus (Kirby.) mexicanus-Paratettix. toltecus-Paratettix. Tragocephala brevipennis-Chortophapacifica-Chimarocephala. Trimerotropis albescens McN. bifasciata Brun. cæruleipennis Brun. cæruleipes Scud. californica Brun. calignosa McN. cincta (Thom.) conspersa McN. coquilletti McN. cristata McN. fallax Saus. ferruginea McN. stigmosus—Hippiscus. zapotecus-Hippiscus. pacifica Brun. pilosa McN. porrecta McN. pseudofasciata Scud. rebelis (Saus.) similis Scud. suffusa-cincta. tesellata McN. thalassica Brun. variegata McN. vinculata Scud. Thrincus aridus-Heliastus. californicus-Heliastus. minimus-Heliastus. Xanthippus aurilegulus—Hippiscus. cathulus—Hippiscus. lateritius—Hippiscus.

pardalinus-Hippiscus.

LOCUSTIDÆ.

The Locustidæ have been called in some of the books, locusts because of the family name and sometimes grasshoppers because of their grass-green color. Most of the males have the wings modified into musical organs and the best known species is called katd-did because of its song and this name has come to be used for the whole group. Many of the California species are wingless and therefore voicless.. Our largest forms are locally called "potato bug."

SYNOPSIS OF GENERA.

Stenopelmatus: wingless and withous pulvilli.

Ceuthophilus: wingless. Tropidischia: hind tibiæ spined on both sides. Gamhaurotettix: front tibiæ hollowed out beneath. Prixocnemis and Udeopsylla: palpi short, the last with third joint shorter than fifth.

Tropizaspis: with short useless wings and prosternum with two spines.

Calcopteris: with short useless wings. Anabrus: front tibiæ spined above on both margins. Atelophus: with but one spine above. Clinopleura: with four. Idiostatus: with feeble lateral carinæ on thorax. Steiroxys and Idionotus: with carinæ well developed and divergent behind in the last.

Scudderia. Dichopetata: front coxæ unarmed. Arethæa: hind margin of wings sinuate. Platylyra: front wingsas long as hind wings.

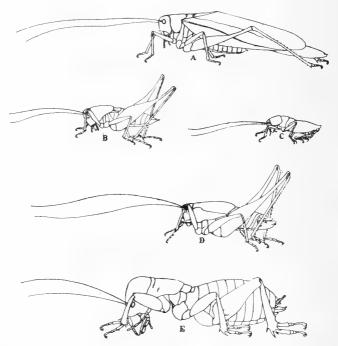


Figure 329. Common California katydids. A Scuderia furcifera. B. Anabris simplex. C. Ceuthophilus pacificus Ateloplus notatus. E. Stenopelmatus irregularis.

Anabrus simplex
Arethæa consuetipes Scud.
Arytropteris steindachneri—Tropizaspis.

Ateoplus notatus Scud.
Calcopteris æqualis Scud.
femorata Scud.
fuscopunctatus Scud.

Capnobotes brunneri Scud.
occidentalis (Thom.)
Ceuthophilus bilobatus—Gamarotettix.
californicus Scud.
celatus Scud.

Dichopetala brevicauda Scud.
Gammarotettix bilobatus (Thom.)
californicus—bilobatus.
Hemiodopsylla californicus Scud.
platiceps S.&P.

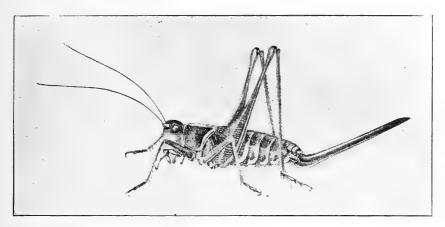


Figure 330. Clinopleura meianopleura, femate.

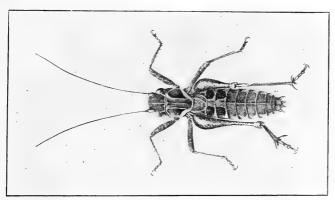


Figure 331. Clinopleura melanopleura male.

henshawi Scud.
pacificus Thom.
vinculus Scud.
Clinopleura flavomarcinata Scud.
melanopleura (Scud.)
conocephalus acutalus Scud.
mexicanus Saus.

Idionotus brunneus Scud.
Idiostatus bilineatus (Thom.)
hermani (Thom.)
Locusta occidentalis..Capnobotes.
Orchelimum agile Deg.
Phaneroptera mexicana—Scudderia.
Prixocnemis validus Scud.

Platylyra californica Scud. Raphidophora xanthostoma—Tropidischia.

Scudderia furcifera Scud. mexicana (Saus.)

Steiroxys bilineatus-Idiostatus. borealis Scud.

> hermani..ldiostatus. melanopleura-Clinopleura.

histrio Saus.

Stenopelmatus californicus Brun. irregularıs Brun.

longispina Brun. oculatus Scud. pictus Scud.

Tropidischia Xanthostoma (Scud. Tropizaspis castanea Scud. diabolica Scud.

ovata Scud. steindachneri (Herm.)

Udeopsylla nigra Scud. Xiphidium occidentale Morse. spinosum Morse. -

GRYLLIDÆ.

The crickets have musical organs on the wings slmliar to those of the Locustidæ with which family they are very closely allied.

SYNOPSIS OF GENERA.

Gryllus. 1775. assimilis. 1838. pensylvanicus: totally black. 1901. intiger. black except wings. vocalis: black except shoulder stripes.



Figure 332. Common California crickets. A. Nemobius mexicanus. B. minutus. C. Gryllus vocalis. В. Tridactylus

Gryllus assimilis Fabr. intiger Scud. pennsylvanicus Burm. vocalis Scud.

Gryllotalpa cultiger Uhl. Myogryllus sicarius Scud. Myrmecophila formicarium Scud. Nemobius mexicanus Walk.

neomexicanus Scud. Œcanthus californicum Walk. Tridactylus apicalis Say. minutus Scud.

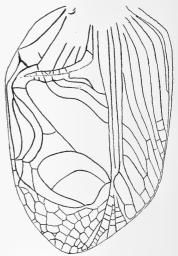


Figure 333 Front wing of a male cricket snowing modification as a musical or-

MANTIDÆ.

The Mantids are predatory, catching other insects by their greatly developed front legs.

Litaneutria obscura Scud. pacifica Scud.

skinneri Rehn. Stagmomantis californicus R.& H.

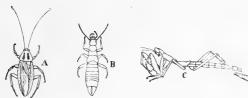


Figure 334. Common California Orthopptera. A. Blatella germanica. B. Sphingolabis californicus. C. Litaneutria pacifica.

PHASMIDÆ.

The Phasmidæ includes the walking sticks and the leaf insects of the trocics. Only a fev rare species of walking sticks occur in this state.

Pacillus coloradus—Parabaseillus. Parabaseillus coloradus Séud. Pseudespermyle arbuseula Rehn. truncata Caud.
Spermyle arbuscula—Pseudospermyle.
Timena californicus Scud.

FORFICULIDÆ.

We have one fairly common wingless species ofearwig.

Doru linearis (Dorn.) tæniata (Dorn.) Prolabia arachnis Yer. Sphingolabis californica—Doru linearis. tæniata—Doru.

BLATTIDÆ.

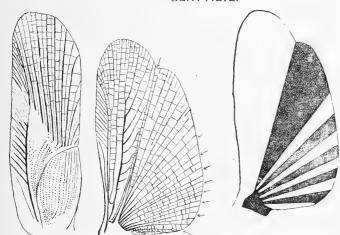


Figure 335. Venation of a cockroach.

Figure 336. Folding of the wing of a cockroach.

Cockroaches have not been annoyed by cockroaches till the last few years and now only in very limited localities.

Blatta orientalis Linn. germanica—Blattella. Blattella germanica (Linn.) Cryptocercus punctulatus Scud. Loboptera americanum Scud Planchora hyalina Saus. Phyllodromia germanica—Blattella. Stylopyga orientalis—Blatta.

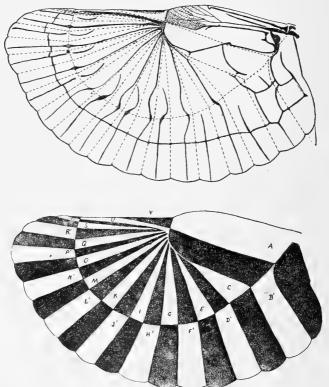


Figure 337. Venation and method of folling of the wing of an earwig.

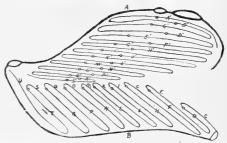


Figure 338. Section across the folded wing of an earwig. The numbers locate the areas shown in figure 337.

CORRODENTIA.

Under the name Corrodentia are now assembled three very distinct groups evidently closely related but differing so in habits and structure as to seem to many to deserve rank as independent orders. The larger group usually designated as the Mallophaga, the biting bird lice, have very evidently been derived from the Psocina in rather recent times probably coincidently with their hosts. The termites are very ancient and are the only group in the order with abundant fossil remains, the others being of too small size and delicate structure.

SYNOPSIS OF FAMILIES.

Philopteridæ: antennæ five-jointed.

Liotheidæ: antennæ concealed, four-jointed. Gyropidæ: feet with one claw.

Trichodectidæ: antennæ three-jointed.

Termitidæ: feet four-jointed. Embiidæ: thoracic segments as long as broad

Psocidæ. Atropidæ: no ocelli.

PHILOPTERINA.

The bird lice are as a rule confined to one or a few related host species. The following list gives the hosts of the California species.

Grebe Docophorus lari, pertusus. Menopon tridens Nirmus fuscomarginatus. Loon Docophorus columbinus, graviceps, lari. Lipeurus faralloni. Menopon tridens. Puffin Colpocephalum perplanum. Nirmus pacificus. Auklet Docophorus acutipectus, atricolor, montereyi. Nirmus maritimus. Murrelet Docophorus atricolor, montereyi. Guillemot Docophorus procax. Nirmus fuscomarginatus, pacificus. Murre Docophorus calvus. Jaeger Docophorus melanocephalus. Nirmus triangularis. Lipeurus laculatus. Kittiwake Docophorus lari Nirmus lineolatus. Gull Colpocephalum funebri. Docophorus lari. Menopon infrequens. Nirmus felix, lineolatus. Tern Docophorus melanocephalus. Menopon tridens Nirmus hebes, præstans. Albatros Colpocephalum pingue. Eurymetopus brevis.

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Gibelia mirabilis. Lipeurus concinnus, densus, diversus, ferox. Menopon irrumpens, navigans. Nirmus giganticola. Fulmar Ancistroma gigas. Docophorus occidentalis. Eurymetopus brevis. Lipeurus celer, varius. Menopon numerosum. Nirmus maritimus. Shearwater Ancistroma gigas. Docophorus validus. Eurymetopus brevis. Giebelia mirabilis. Lipeurus diversus, fuliginosus, laculatus, limitatus, testaceus. Menopon paululum, petulans. Nirmus giganticola, pacificus. Cormorant Lipeurus Faralloni, toxoceros. Menopon titan. Pelican Colpocephalon unciferum. Lipeurus bifasciatus, furficulatus, toxoceros. Menopon consanguinium, titan. Merganser Docophorus icteroides. Lipeurus squalidus temporalis. Trinoton lituratum, luridum. Duck Docophorus icterodes. Lipeurus constrictus, squalidus. Menopon loomisii. Trinoton lituratum, luridum. Rail Menopon tridens Oncophorus bisetosus. Coot Docophorus graviceps, minutotrabeculatus, pertusus, quadraticeps. Læmobothrium atrum. Lipeurus longipilus, luridus, picturatus. Menopon tridens. Oncophorus advena, minutus. Phalarope Nirmus furvus. Sandpiper. Docophorus fusiformis. Nirmus complexivius. Sanderling Colpocephalum spinulosum. Nirmus actophilus, complexivus. Godwit Nirmus cordatus. Plover Colpocephalum timidum. Docophorus fuliginosus. Nirmus opacus. Partridge Goniodes mammillatus Lipeurus docopheroides. Grouse Lipeurus perplexus. Goniodes mammillatus. Ptarmigen Goniodes mammillatus. Chicken Goniocotes abdominalis. Menopon biseriatum, pallidum, Pheasant Gosiocotes creber. Kite Colpocephalum filavescens, osborni. Menopon decoratum Nirmus fuscus. Hawk Colpocephalum flavescens. Nirmus fuscus. Eagle Colpocephalum flavescens. Docophorus pictus. Owl Docophorus cursor, rostratus, speotyti. Woodpecker Docophorus californiensis, singularis. Menopon funereum. Sapsucker Docophorus californiensis. Flicker Lipeurus macrocephalus. Hummingbird Nirmus eustigmus, vulgatus. Physostonum. Kingbird Nirmus fædus. Flycatcher Docophorus communis, fuscoventralis, rufus. Menopon distinctum. Nirmus fædus, vulgatus. Physotomum sucinaaceum. Phæbe Nirmus fædus. Lark Docophorus communis. Jay Docophorus communis Nirmus vulgatus. Menopon persignatum. Raven Colpocephalum subæquale. Crow Menopon mesoleucum. Blackbird Docophorus communis. Meadowlark Docophorus communis. Oriole Docophorus Communis. Grosbeak Menopon funereum. Finch Docophorum communis. Menopon incertum. Nirmus vulgatus. Physotomum microcephalum. Longspur Docophorus communisSparrow Docophorus communis, Menopon incertum, mæstum, Nirmus latiusculus, vulgatus. Physotomum diffusum. Junco Docophorus communis.. Nirmus vulgatus. Songsparrow Colpocephalum chrysophæum, grandiculum. Docophorus communis. Menopon mæstum. Towhee Colpocephalum grandiculum. Docophorus communis. Nirmus vulgatus. Cardinal Docophorus communis. Bunting Nirmus vulgatus. Tanager Docophorus communis. Swallow Menopon mallens. Nirmus longus. Waxwing Docophorus communis, incisus. Nirmus brachythorax. Phainopepla Nirmus fædus. Shrike Docophorus communis. Nirmus fædus. Warbler Docophorus communis. Menopon ridulosum, Nirmus vulgatus. Chat Nirmus fœdus. Dipper

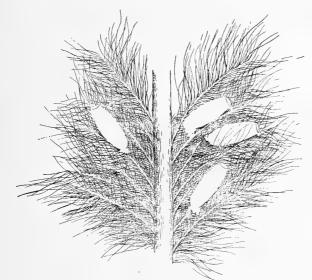


Figure 339. Eggs of Menopon pallidum.

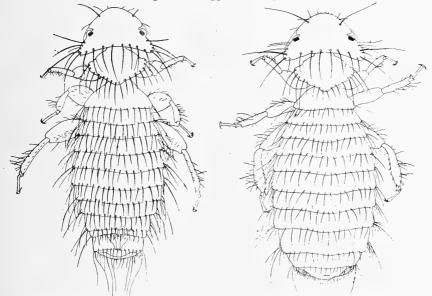


Figure 340 A chicken louse Menopon pallidum. The two sexes.

Nirmus vulgatus. Thrasher Docophorus communis. Wren Docophorus communis, mirus. Menopon distinctus, incertum, malleus. Titmouse Docophorus communis. Chicadee Nirmus vulgatus. Bushtit Colpocephalum fumidum, Menopon robustum. Robin Docophorus communis. Nirmus vulgatus. Bluebird Docophorus Communis, incisus. Fox Trichodectes quadraticeps. Pocket gopher. Trichodectes geomydis. Skunk Trichodectes mephitidis.

LIOTHEIDÆ.

SYNOPSIS OF GENERA.

Menopon: eyes not in hollows. Physotomum: sides of head straight. Ancistrona: length over 5 m.m.

Colpocephalum. Trinoton and Læmobothrum: forehead with lateral swelslings, the last with meso and metathorax fused.

Ancistrona gigas Piag.

Colpocephalum chrysophæum Kel.

epinulosum Piag. flavescens Nitz. fumidum Kel. funebre Kel. grandiculum Kel. numerosum Kel. osborni Kel. perplanum Kel. pingue Kel. spinulosum Piag.

strictum K.&P.

subæquale Nitz.

ridulosum K.&C. robustum Kel. titian Nitz. timidum Kel. unciferum Kel.

Menopon biseriatum Piag. consanguineum Piag. decoratum Kel. distinctum K.&C.

funereum K.&C. incertum Kel. infrequens Kel. irrumpens K.&C. · loomisii Kel. malleus Nitz. mesoleucum Nitz. mæstum K.&C. numerosum Kel. navigans Kel. monstæchum Kel. pacificum-tridens. palulum K.&C. persignatum Kel. petulans K.&C. tridens Nitz. Trinoton lituratum Nitz. luridum Nitz.

Læmobothrium atrum Nitz. Physotomum diffusum Kel. microcephalum Kel. prominans K.&C.

sucinaceum Kel.

TRICHODECTIDÆ.

Trichodectes geomydia Osb. mephitidis Osb.

quadriceps Chap.

PHILOPTERIDÆ.

SYNOPSIS OF GENERA.

Lipeurus: body narrow. Nirmus: antennæ alike in both sexes. Oncophorus: legs short.

Docophorus. Eurymetopus, Gonioides and Goniocotes: with antennæ unlike in the sexes, the first with the last abdominal segment emarginate, the second with an appendage on third antennal segment. Giebelia: with membraneous appendage on forehead.

Docophorus acutipectus Kel. atricolor Kel.

californiensis Kel. calvus Kel.

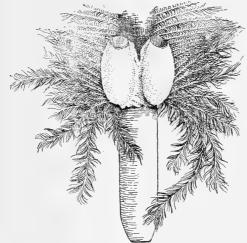


Figure 341. Eggs of Goniocotes abdominalis.

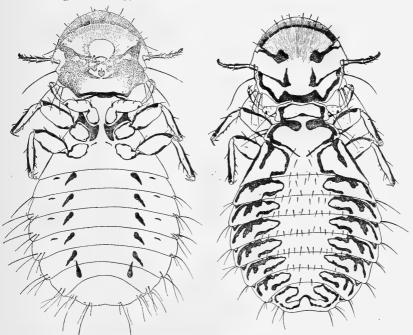


Figure 342. A chicken louse Goniocotes abdominalis upper and lower view.

columbinus Den. communis Nitz. cursor Nitz. fusiformis Den. fuliginosus Kel. fuscoventralis Osb. gigantula Kel. graviceps Kel. Icterodes Nitz. incisus Kel. lara Den. langus Kel. melanocephala Burm. mirinotatus K.&C. mirus Kel. monachus—pertusus. montereyi Kel. occidentalis Kel. pertusus Nitz. pictus Gieb. platyrhynchus Nitz procax K. & C. rostratus Nitz. rufus Kel. singularis K.&C. spectyti Osb. validus K.&C. Eurymetopus brevis Duf. Giebelia mirabilis Kel. Goniocotes abdominalis Piag. creber Kel. Goniodes curvicornis Gieb. mammilatus Rud. Lipeurus californicus—docophoroides. celer Kel. concinnus Kel. constrictus Kel. densus Kel. diomedia Fabr. diversus Kel. docophoroides Piag. faralloni Kel. ferox Gieb.

forficulatus Nitz. fuliginosus Tash. gracilicornis Piag. laculatus Kel. limitatus Kel. longipilis Kel. macrocephalus Kel. perplexus Kel. snodgrassi Kel. squalidus Nitz temporalis Nitz testaceus Tasch. toxocerus Nitz. varius Kei. Nirmus actophilis K.&C. americanus-fuscomarginatus. brachythorax Gieb. complexius K.&C. cordatus Osb. ductilis K.&C. eustigmus Kel. felix Gieb fœdus K.&C. fuscomarginatus Den. furvus Nitz. fuscus Nitz. gigantula Kel. hebes Kel. incœnis K.&C. latiusculus K.&C. lineolatus Nitz. longus Kel. maritimus K.&C. opacus K.&C. pacificus Kel. præstans Kel. punctatus Nitz. triangularis Nitz vulgatus Kel. Oncophorus advena Kel. bisetosus Piag. californicus-bisetosus.

minutus Nitz.

TERMITINA.

TERMITIDÆ.

In the tropics the termites or white ants easily take first place as insect pests but here in California thes are rarely more than objects of interest because of their habits, particularly the annual flight of the winged forms and the great numbers of discarded wings to be seen at the close of the day.

Very little is known of the colony life of our species. One will often find

colonies in rotten logs or in the ground. The queen probably lives in the ground as she is never seen in the infested log when that is torn to pieces to study the colony.

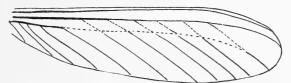


Figure 343. Diagram of the venation of the white ants.

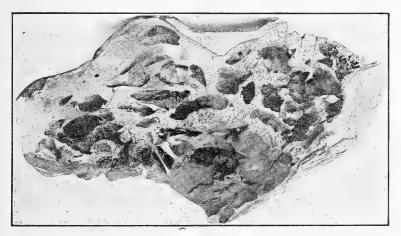


Figure 344. Work of a white ant.

Callotermes castaneus Burm.
marginipennis Latr.
Termes flavipes Kol.
lucifugus Ros.
angusticollis—Termopsis.

castaneus—Callotermes.
marginipennis—Callotermes.
Termopsis angusticollis Walk.
occidentalis Walk.

EMBIIDÆ.

Embia californica Banks.

PSOCINA.

ATROPIDÆ.

Leptinotus piceus Mots.

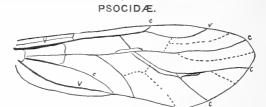


Figure 345. Diagram of the venation of the Psocidæ,

Elipsochus punctatus Banks. Myopsochus macuiosus Banks.

Cæcilius aurantiacus Hag. clarus Banks.

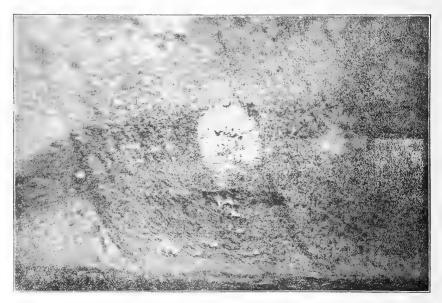


Figure 346. The egg tent of a Psocid.



Figure 347 Venation of a Psocid.

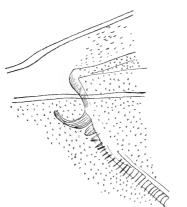


Figure 348. Hook on the wing of ; Psocid.

EPHEMERIDA.

The mayflies are not well represented in California. The nymphs are Their venation shows perhaps the largest number of veins found tached to the wing root and the musculation of the thorax is different from that of preceeding orders.

EPHEMERIDÆ.

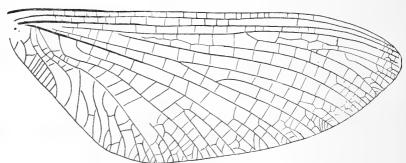


Figure 349 Venation of a mayfly Ameletus exquisitus—Siphlurus. undul

Bætisca obesa Say. Bætis obesa-Bætisca. Callibætis californicus Banks. hageni-tessellatus.

pictus—undulatus. tessellatus Hag.

undulatus Pict. Heptagenia nitidus Eat. Iron nitidus-Heptagenia. Leptophlebia rufivenosus Eat. Siphlurus dissitus Eat. exquisitus Eat.

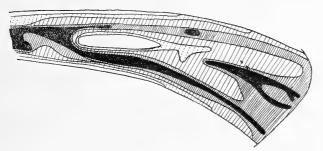


Figure 350. Diagram showing variation of surface level in a mayfly wing.

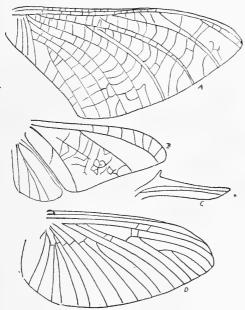


Figure 351. Unusual venations of mayflies.

ODONATA.

These insects are carnivorous both as young and adults. The nymphs are aquatic and notable on account of the greatly developed under lip, which has become a grasping organ for securing their prey. The adults are familiarly known as "dragonflies" "darning needles" "snake feeders or doctors." There are seven families the last two being sometimes distinguished as damselflies

SYNOPSIS OF FAMILIES.

Agrionidæ: eyes hemispherical. Calopterygidæ: five or more antecubitals. Libellulidæ: antecubitals corresponding. Cordulidæ: eyes tubercled behind.

omphidæ. Æschnidæ: eyes approximate. Corduligasteridæ: touching at but a single point.



wing of Odo-

Figure 352. Diagram of the wing of Odonata. a. arculus. n. node. n.S. nodal sector. s. stigma, t. triangle.

Figure 353. Diagram of the venation of fossil dragonflies.

LIBELLULIDÆ.

Delona odiosa—Libellula.
saturata—Libellula.
Diplax corrupta (Hag.)
flavocosta—mandida.
hageni Cal.
mandida Hag.
semicincta (Say.)
Lepetrum corrupta—Diplax.
forensis—Libellula.
Libellula forensis Hag.
longipennis—Pachydiplax.
lydia Dru.
odiosa Hag.

pulchella Dru.
saturata Uhl.
semicincta—Diplax.
simplicicollis—Mesothemis.
subornata Hag.
Mesothemis collocata—simplicicollis.
illcta Hag.
longipennis—Pachydiplax.
simplicicollis (Say.)
Platythemis subornata—Libellula.
trimaculata—Libellula.
Pachydiplax longipennis Burm.

ODONATA.

CORDULIDÆ.

Epopthalmia elegans Brau. Micromia pacifica Hag. magnifica Say.

ÆSCHNIDÆ.

Æschna californica Hag. constricta Say. juncea (Linn.) validus—walsinghami. walsinghami McL. junius—Anax. Libellula juncea—Æschna.

CORDULEGASTERIDÆ.

Cordulegaster dorsalis Selys.

GOMPHIDÆ.

Diastatomma bison—Ophiogomphus.
obscurus—Progomphus.
Gomphus confraternus Selys.
olivaceus Selys.
sobrinus Selys.

specularis—Octogomphus.
Neogomphus specularis—Octogomphus.
Octogomphus specularis Selys.
Ophiogomphus bison Selys.
Progomphus obscurus Ramb.

AGRIONIDÆ.

Agrion definum—Ischnura ramburii. exclamationis Selys. ramburii—Ischnura.

Argia agrioides Calv. vivida Selys.

Conagrion exclamationis—Agrion.

Enallagma civile Hag. cyathigerum—robusta. robusta Selys.

Erythagrion salvum Hag. Ischnura cervula Selys.

defixa—ramburii.
erratica Calv.
exstriata Calv.
perpava Selys.
ramburii Selys.

ramburii Sely Lestes stulta Hag. uncata Kirb.

unguiculata Hag. Micronympha cervula—Ischnura. defixa—Ischnura ramburii.

Oxyagrion rufulum Hag. Pyrrosoma abbreviata Selys.

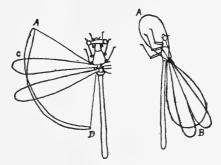


Figure 354. Agrion, showing figure 8 path of wing as seen from adove and from the side. A. position of wing when ready to fly. B. position of complete rest. C. position of rest with expanded wings.

CALOPTERYGIDÆ.

Calopteryx maculata Beau. Euthore fasciata (Salys.) Hetærina californica Selys. Thore fasciata—Euthore.

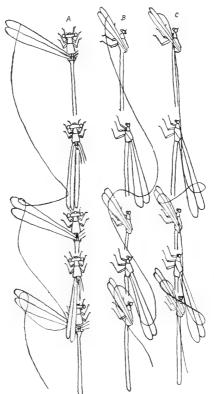


Figure 355. Diagram ilustrating the fight of Agrion A. From above, the curved line showing the path of the stigma. B. From the side, according to the theory of von Lendenfeldt. C. From the side, according to the theory of Marey.

NEUROPTERA.

The order Neuroptera is very frequently divided on the basis of metamorphosis, and the two or three preceding orders have been combined with part or all of the order. Each of the superfamilies is sometimes considered a distinct order.

SYNOPSIS OF FAMILIES.

Myrmeleonidæ: antennæ enlarged at tip.

Sericostomatidæ: wings clothed with hair. Limnephilidæ: legs spiny. Leptoceridæ, Rhyacophilidæ and Hydropsychidæ: male palpi five-jointed, the first two with last joint elongate, the second with the basal joint of antennæ long.

Chrysopidæ: prothorax distinctly wider than long. Hemerobiidæ: anten nal joints beadlike.

Raphidiidæ: prothorax much longer than wide.

Panorpidæ: mouth at end of long trunk.

Sialidæ. Perlidæ: feet three-jointed. Mantispidæ: front legs much enlarged. Conjopterygidæ: body and wings covered with a white powder.

PHRYGANINA.

RIACOPHILIDÆ.

Agapetus celatus McL. Riacophila angelita Banks.

basalis Banks.

PSYCHOMYIDÆ.

Tinodes consueta McL.

HYDROPSYCHIDÆ.

Diplectrona nigripennis Banks. Hydropsyche californica Banks.

ODONTOCERIDÆ.

Neurophilus californicus Hag. plutonius Banks.

Silo californicus-Neurophilus.

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SERICOSTOMATIDÆ.

Helicopsyche californicum Banks. Lopodostoma cinereum BaBnks. Nosopus podiger McL. Notidobia griseola McL. nigricula McL. Silo californicus Hag. cinereus—Lepidostoma.

CALAMOCERATIDÆ.

Heteroplectron californicum McL.

LIMNEPHILIDÆ.

Limnephilus gravidus Hag. Platyphylax designatus Walk. occidenta.s-designatus.

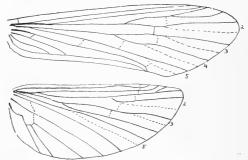


Figure 356. Venation of the larger Phryganeidæ.

PANORPINA.

PANORPIDÆ.

This family includes the scorpion flies, so called because the abdomen in some cases mimic the sting of a scorpion. The larvæ live in the ground and both larvæ and adults are carnivorous.

Bittacus apterus McL. chlorostigma Mcl.

Boreus californicus Pack.

HEMEROBINA

CHRYSO & IDÆ.

The lace wing flies feed on aphids. The eggs which are laid on long stalks are conspicuous objects on the leaves of aphid infested trees.

Eremochrysa californica Banks. gravida Banks.

punctinervis McL.
Chryscpa californica Coq.
externa Hag.

gravida Banks.
marginalis Banks.
punctinervis—Eremochrysa.
Nothochrysa californica Banks.



Figure 357. Chrysopa larva.



Figure 360. Hemerobius larva

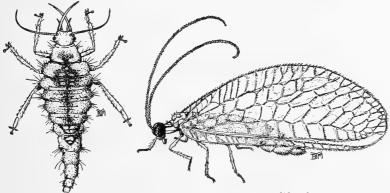


Figure 358. Green Lacewing, Chrysopa californica.

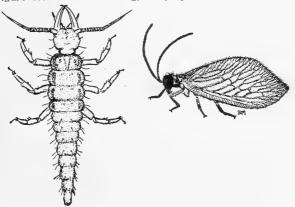


Figure 359. Brown Lacewing. Hemerobius pacificus.

HEMEROBIDÆ.

The larvæ of these insects cover the body with excrement and rubbish. They feed on plantlice. Boriomyia coloradensis Banks. Hemerobius mœstus Banks. Polystochotes punctulatus Fabr.

tutatrix (not California.) Sympherobius angustus Banks. californicus Banks.

MYRMELEONIDÆ.

These are the antlions or as the children usually call them "doodle bugs" The larvæ make conical pitfalls in the sand and lie buried at the bottom of the burrow till some insect falls in the pit and then they grasp it, pull it under the sand and proceed to suck its blood.

Acanthaclisis fallax (Ramb.) Brachynemurus coquilletti Cur. exitalis (Walk.) ferox (Walk.) longipalpus Hag. maculosis BBanks. minusculus Banks. peregrinus-Myrmeleon. quadripunctatus Cur. Dendroleon obsoletum (Say.)

pacificus Banks.

sackeni Hag. Formicalio obsoletum-Dendroleon. Maracandula beliula Banks. Myrmeleon distans Banks. exitialis-Brachynemurus. fallax—Acanthaclisis. ferox—Brachynemurus. immaculatus Dru. peregrinus (Hag.)

CONIOPTERYGIDÆ.

Small insects with wings covered with a white powder. The larvæ feed on the eggs of red spiders, puncturing them and lapping out th contents Coniwentzia hageni Banks.

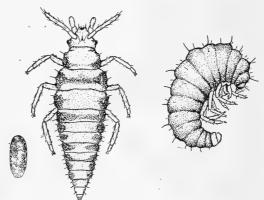


Figure 361. Conventzia hageni, Eggs, larva, pupa.

MANTISPIDÆ.

Carnivorous insects living on vegetation and capturing rather large prey. Symphasis signata Hag.

RAPHIDIDÆ.

These insects are carnivorous, living in the ground as larvæ and in the grass as adults.

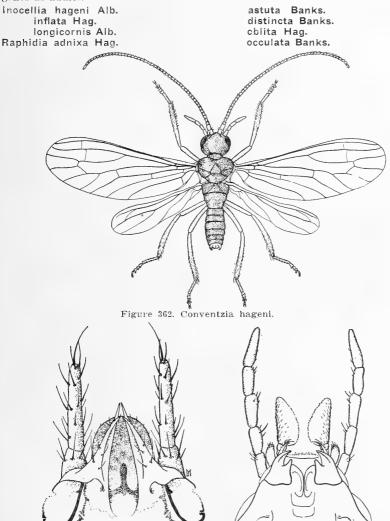


Figure 364. Conventzia hageni. Mouth- Figure 363. Conventzia hageni. Mouth-parts of adult.

SIALIDÆ.

The larvæ are aquatic and carnivorous.

Chauliodes californicus Walk. disjunctus Walk. minimus Dav. Sialis fuliginosa Pict. infumata Newm. nevadensis Dav.

PERLINA.

PERLIDÆ.

Aquatic insects in their early life living beneath stones, etc., at the bottom of streams and ponds and feeding on decaying vegetable matter.

Alloperla continua Banks. Dictyopteryx signata Hag. Perla californica Banks. concolor Banks.
Pteronarchus californicus Newp.
proteus Newm.



Figure 365. Venation in Nemourâ.

APTERA.

The members of this order are mostly insects of very small size living in damp situations and feeding on decaying vegetable matter.

SYNOPSIS OF FAMILIES.

Entomobriidæ: abdomen with ventral tube on first segment. Lipuridæ: legs very short. Smynthuridæ: segments of abdomen obscure.

Lepismidæ. Campodeidæ: middle tail feeble or wanting. Machilidæ: outer tails shorter. Japygidæ: with pincers instead of tails.

become extremely abundant in the soil and after rains are often found float-

SMYNTHURIDÆ.

Papirus maculosus Sch. Smynthurus albipes Sch.

luteus Lub. niger-albipes. plicatus Cch. LIPURIDÆ.

They often

eisenii Sch. This family includes the smallest members of the order.

ing on pools as a film completly covering the surface. Achorutes armatus Nic. Lipeura inermis Tull. Xenella maritimus (Fabr.)

viaticus (Linn.)

ENTOMOBRIIDÆ.

These are very common insects found most frequently at the surface of the ground under stones, fallen leaves, etc., particularly in moist situations. On cloudy days they may often be seen abundantly running over leaves of grass real pests, gnawing off the surface of the leaves and showing a decided preference for the petals of flowers.

Podura maritimus-Xenella. viaticus-Achorutes.

Degeeria marginata-Entomobria. multifasciata-Entomobria.

Drepanura californica Sch. Entomobria atrocincta Sch. binoculata Sch.

cœca Sch. curviseta Bro.

marginata (Tul.) multifasciata (Tul.) nivalis (Linn.) sexoculata Sch. Isotoma balteata—palustris. fimetaria (Linn.) lacustris Sch. palustris (Mul.)

viridis (Mul.)

Orchesella rufescens (Linn.)
Podura fimitaria—Isotoma.
nivalis—Entomobria.
palustris—Isotoma.
rufescens—Orchasella.

viridis—Isotoma. S'era purpurea Sch. Templetonia quadroculata Sch. Tomocerus niger Bour.

Evalljapyx diversipleura sil. propinquus Sil.

JAPYGIDÆ. Japyx diversiunguis Sil.

MACHILIDÆ.

Machilis aurantiacus Sch.

LEPISMIDÆ.

lepisma reticulata Sch.

CAMPODIDÆ.

Campodea staphylinus Westw.

APPENDIX.

The preceding pages deal very largely with the classification of insects. To the majority of students the identification of an insect is simply for the purpose or finding the literature of the insect in question. The science of entomology is much broader. Below will be found suggestions and helps for the study of insects from a somewhat broader view point.

COLLECTING INSECTS.

Every student in entomology is urged to make a collection of insects, both for the purpose of securing material for the study of classification which every one should understand, and for the purpose of securing first hand

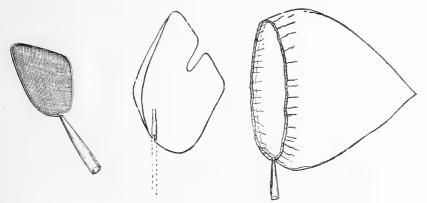


Figure 357. Sweep net, beating net and water net.

information concerning their habits and mode of life. One will find insects almost everywhere, and many can be secured and preserved without the use of any special equipment. Papers for holding insects are usually folded into 343

triangles as follows: For the larger Lepidoptera and Odonata use a piece of paper the shape and size of a page of this book, folding it obliquely across the middle, doubling over the projecting ends and turning the corners over again making a triangular envelope. One side is now opened, the insect inserted and then it is closed up again and the two acute angles are twisted over and pinched together effectively sealing the envelope. For most butterflies and other insects a sheet of paper a half, a quarter or even an eighth the size if this page would be used. Insects liable to injure themselves in the paper may be killed by a drop of gasolene, benzine, chloroform or ether which will soak thru the paper, or the envelope may be held for a moment over a flame, heat being very quickly fatal to all insects. The common gelatin to be had at any drug store is one of the most satisfactory containers for specimens of insects and should be regularly carried in the pockets of every collector.

On collecting trips a net and a cyanide bottle are almost always carried by insect collectors. A butterfly net is usually made of mosquito netting or some similar fabric, made bag-shaped and two or three times as deep as the diameter. The best nets for sweeping and general collecting is a conical hag about a foot in diameter and a foot and a half to two feet deep. A special shallow net, preferably of wirecloth. Electric lights or any kind of this net is an extension at the tip of the bag to hold a quarter pound paper bag, a narrow sleeve on the inside fits into the paper bag and the insects are driven into this bag by the motion of the net. The paper bags are replaced as fast as they are filled and the insects brought in alive or placed bag and all in a large cyanide jar. The particular advantage of this net is the good condition of the insects even when captured in wet grass.

The net hoop may be made by bending a piece of wire into a hoop, the two ends being bent out at right angles so as to lie adjacent and parallel with each other. These ends are then inserted into the small end of a six-inch tin ferrule and soldered fast. This ferrule may serve as a handle or fitted over the end of a handle and held in place by a tack.

The cyanide bottle is by far the most convenient means of killing insects for the collection. A wide-mouthed bottle with an easily removed cork is charged with a small lump of cyanide, the vapor given off from which quickly kills any insect which may be enclosed.

The cyanide may be covered with wet plaster of paris, which sets at once holding the cyanide in place and preventing the insects from coming into direct contact with the poison, which might discolor them. The plaster may be put into the bottle dry and water added carefully so as to wet only a thin layer of the plaster, tamping it so as to leave no cavities. This dries quicker and is more easily removed when it is desired to recharge a bottle. In either case the bottle must be thoroly dried before using and redried if it becomes wet, otherwise the specimens may be injured. Another method preferred by

some is to cover the cyanide with sawdust, excelsior, cotton, crumpled paper or any material which will absorb the moisture and hold the cyanide in place, and cover with a piece of cardboard cut so as to fit tight in the bottle. To insure its holding in position, some fasten the edges with shellac or collodion or some other material not affected with moisture.

The use of the sweep net is the most prolific method of collecting. The method of sweeping is simply to swing the net back and forth so that the open mouth will strike across the tops of the grass or other plants. The end of the net quickly fills with rubbish in which a large assortment of insects will be found. They are usually not sorted out until after the insects are killed.

Flowers of many kinds furnish a rich source for specimens. One can use a net or catch many by hand or with a cyanide bottle. Under boards and stones and under the bark of logs and stumps are the richest places for hand collecting. Collecting in the water is often very prolific but requires a special shallow net, preferably of mirecloth. Electric lights or any kind of light is attractive to many insects that fly on warm evenings, and bait of molasses mixed with beer or other alcoholic liquor is also very attractive to night flying insects and is often made use of by insect collectors..

REARING INSECTS.



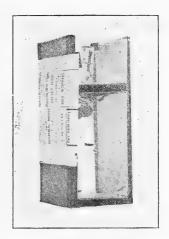


Figure 358. Paper box and lamp chimney cage.

The following out of the life history of insects requires the use of a cage. Cages may be made of all manner of shapes and sizes. Jelly glasses and chimneys of lamps or lanterns are very largely used. Some prefer paper boxes because the air never deposits moisture on the sides. It is distinctly best to keep the insects separate or with very few together and to use new or steril-

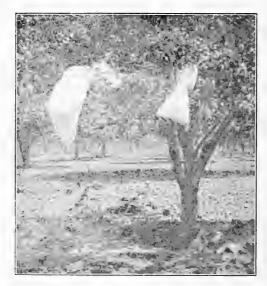


Figure 359 Bag cages on tree

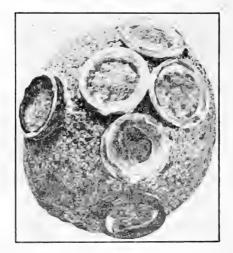


Figure 360. Cover glass cages on orange.

ized cages, because insects are sometimes subject to contagious diseases which are very fatal,

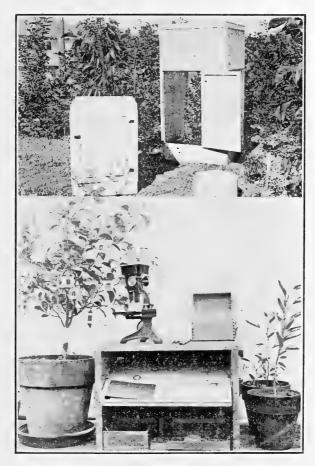


Figure 361. General view of an insetary.

Where practical a good plan is to cage the insect under normal conditions as for instance on its food plant. It is usually more convenient to assemble the insects being experimented with in one place, the insectary.

MOUNTING INSECTS.

All large insects should be pinned, using insect pins which should be in-

serted in the thorax to the right of the median line and should emerge, in most cases between the middle and hind legs. One fourth of the length of the pin should be above the insect.

See that dirt that might render the study of the specimen difficult is removed. If the legs are retracted extend them and if the legs or antennæ are unusually long bring them up towards the body so that they may be in less danger of being broken off. Pull out the tongue in the case of bees that the palpi may be seen. It is generally desirable to attempt to determine any unknown insect at pinning time to learn what parts must be studied so that care may be taken to keep these exposed.

Small insects may be mounted by gluing them to the point of paper triangles These should be not over 1 c.m. long nor over 2 m.m. wide at base. The under part of the left side just above the legs should receive the triangle point, the insect being at right angles to the triangle. Before beginning to mount a quantity of triangles should be cut and pinned ready for use.

Velvet mounts are undoubtedly the most convenient method for small insects. Cut white velvet into pieces one inch by three, lay a piece on a microscope slide pile up, arrange the specimens on the velvet and then lay another slide over them fastening the ends with gummed labels. Mount many specimens of each kind, both side up, and see that all significant structures are exposed. Other specimens may be added by breaking the seal at one end and carefully lifting the upper glass.

DRAWING.

The only way to effectively study complicated structures is by drawing them, and the first thing a student should learn is to draw accurately. Accuracy in drawing is almost wholly a question of learning to see and appreciate proportions. One sees the detail and if a feature of the detail is drawn first it will almost invariably be out of proportion. It will not look right but one is at loss to see wherein it fails to correctly interpret the object.

To draw a grasshopper side view for instance proceed as follows:

1st Decide and mark on the paper the total length of body.

2nd Draw the dorsal line locating the proportion the head, prothorax and elytra contribute to this line.

3rd Locate the main ventral line, comparing the width of the thorax with the dorsal length of the prothorax.

4th Locate the hind leg noting the position of the base by its direction from the hind angle of the pronotum, the angle at which it crosses the dorsal line, the length as compared with the elytra, and by the direction the tip of the leg lies from the tip of the wing.

5th Locate the divisions between the abdominal segments.

6th Now proceed to work in the detail, locating the minor points as needed in the same manner as above.

The above directions are sufficient for copying a drawing or for drawing a flat object but where the object has much depth, unless one be already a trained artist he should draw comparison sketches.

Comparison sketches are made of the same size but from a point of view ninety degrees apart. They are drawn in the manner just described, and compared by meanm of a series of parallel lines. Every point in each drawing should compare with the corresponding point in two adjacent figures.

When comparison drawings fail to agree the one in which the object is seen most nearly perpendicularly is likely to be the more accurate. In any case a careful inspection should show which drawing needs to be changed.

USE OF HAND LENS.

Insects are so small that the use of a magnifier is essential in their study and every student should be provided with a good pocket magnifier. A $\frac{3}{4}$ inch (18 m.m.) or a $\frac{1}{2}$ inch coddington is recommended as a good quality cheap lens and a triplet where one wants the best lens available. The fractional designation of lenses indicates the magnification. The normal focus of the eye is assumed to be ten inches (250 m.m.) and a lense that magnifies twenty times is called a $\frac{1}{2}$ inch lens because the lens causes the rays from the object to enter the eye as tho the object were but half an inch away, the pupil remaining adjusted for the normal ten inch vision.

In selecting a lens avoid any showing serious aberration. Aberration is of two kinds, chromatic and spherical. Chromatic aberration may be detected by first putting the lens very close to a printed page and slowly withdrawing it. As the letters begin to lose their distinctness, more or less color will be seen around them. A lens should be rejected if these rainbow colors are very pronounced. Spherical aberration may be seen when the lens is removed still further from the page when the letters will appear distinct again but small and upside down. If the lines are straight and not closer together at the ends the lense is of good quality in this respect.

The most important thing in the use of a lens is to see that the point at which one desires to look is in the light. Do not allow the head or the lens to throw a shadow on that which you are endeavoring to examine. The next most important thing is to hold all steady. The best plan is to lay the two hands against each other, one holding the object, the other the lens and bring the cheek against the hand with the eye as close to the lense as possible.

USE OF MICROSCOPE.

A microscope provides for the use of higher magnification than a hand lense by provisions for better illumination of the object and for greater steadimess. The object is usually so prepairer that light can pass thru the tissue, and it rests on a stage, the lenses being brought into focus by a screw adjustment. In using a microscope observe the following points.

- 1. See that the slide containing the object is clean, and free from dust and then lay it on the stage of the microscope.
- 2. Look down the tube and manipulate the mirror till securing the strongest light. If the field is cloudy revolve the eyepiece so as to locate the dirt.
- 3. Move the object as nearly as possible to position and lower the tube of the microscope till the objective is as close or closer than the focus, doing this with the eye almost on the level of the stage.
- 4. Bring the eye to the tube again and turn the focusing screw up (never down) till the object comes into view.

If the instrument needs cleaning bring the fact to the attention of the instructor rather than to try to clean it yourself; however the method of cleaning follows: (a.) brush off all dust. (b.) moisten lens with the breath and wipe gently with a clean cloth. (c.) if these means fail slightly moisten a a cloth with a drop of alcohol and apply carefully.

MICROSCOPICAL MOUNTS.

Microscopical slides are usually made with an aqueous medium or with balsam. Aqueous media are water, sugar solution, mucilage or glycerine jelly. To make these mounts permanent they must be sealed. One of the best method of sealing an aqueous mount is to first mount the preparation between two coverglasses, one much smaller than the other. Now place a drop of balsam on a slide and lay the mount small cover down in the balsam.

Balsam mounts require the removal of the water from the specimen which is usually accomplished by the use of alcohol. The alcohol is then replaced by an oil which in turn is largely replaced by the balsam. The oils most used are xylol, turpentine, clove oil and cedar oil. Carbolic acid is sometimes added to the turpentine. When the object is dry it can be placed at once in the oil or even directly into the balsam.

SECTIONING INSECTS.

For the most careful study of the structure of insects sections are cut bu the use of a microtome. The following method gives good results:

- 1. Place the specimens in a two dram hoho vial, not filling it more than a tenth full, and kill by filling with boiling water.
- 2. Harden tissues with alcohol pouring off. $\frac{1}{4}$ the water and adding alcohol. In half an hour pour off a third and add as much alcohol. An hour later $\frac{1}{2}$ and the next day put in fresh strong alcohol.
- 3. Remove the alcohol by soaking a few minutes in oil of cloves and then place in melted parafine (56 degree.) one or two days, when it is ready to cut.

METRIC EQUIVALENTS.

Comparison of Centigrade and Fahrenheit Thermometers.

59 77 95 113 131 149 167 185 203 86 104 122 140 158 176 194 212 0 - 3250 68 Fahrenheit. 10 20 30 40 50 60 70 80 90 100 Centigrade. 1.6 2.2 .5 1.1 2.7' 3.3' 3.8' 4,4' 3.65.47.21.8

Weights.

Apothecaries — grain 20 scruple 3 dram 8 ounce 12 pound. Avoirdupois — dram 16 ounce 16 pound 2000 ton. froy — grain 24 pennyweight 20 ounce 12 pound.

> Lo Deci-Grand to to Deca-3 6 7 g ₹ 9 | 2 6 7 9 Troy & Apo |3 5 2 7 4 Ounces Avoir. |3 2 1 5 1 Troy & Apo |3 4 3 8 3 Drchm Avoir. Troy & Apoth. 8 I I ₽ τ ₽ zÞ g 6 ₽ 8 Troy & Apoth. 8 0 τ Ŧ 1 Ţ 1 5 $|\mathbf{g}||2$ 7 2 0 6 Apoth. 8 8 T 6 4 3 0 1 4 Pennyweight Troy

Linear Measure..

Meter. ww Hecto-9 Myria Centi om Deci-To Deca-∞ Kilo· 2 1 3 8 Mile. 7 7 6 6 0 9 0 7 ₽ $0 \stackrel{\mathrm{g}}{|} \stackrel{\mathrm{g}}{1}$ 8 4 0 5 6 Rod. g 2 7 3 Ţ 093 6 2 3 1 4 L 6 3 ₽ Ţ 3 9 9 3 3 Foot. 6 2 8 0 8 Ĺ 0 6 ₽ 3 3 7 0 4 1 9 6 Inch. 6 6 3 g 7

Square Measure.

Square measure — sq. inch 144 sq. foot 9 sq. yard $31\frac{1}{4}$ sq. rol 160 acre 640 sq. mile

d.m. c.m. Sq. c.r Milli-Deci-Centi-| 3 7 3 8 Square mile. 2 0 4 3 Acre. 3 6 8 2 Square rod. 0 L L I 6 g ₱ g Ţ. 0 8 19 g 9 5 | 5 8 2 7 2 3 6 8 2 Square rod 1 1 9 6 1 1 5 0 6 0 0 Square yar 0 7 6 4 1 0 3 5 5 3 5 Squarefoot. 0 0 3 0 9 1 1 7 0 6 9 Sq.inch 0 9 8 2 Ţ $^9_{\parallel 1}$ 0 6 0 0 Square yard. T. 8 Ţ 9 8 6 5

Cubic Measure.

Cubic measure — cubic inch 1728 cubic foot 27 cubic yard. Dry measure — pint 2 quart 4 gallon 2 peck 4 bushel. Fluid measure — minim 60 dram 16 ounce 4 gill 4 pint 2 quart 4 gallon.

> Milli-Centi-Deci-Stere, Deca-Hecto-Kilo-Myria-- initial state of the state of Deca-9 0 4 6 4 8 Imperial. τ 0 7 1 5 4 8 3 8 7 2 Dram. G Ţ ₽ 8 7 4 0.8 5 1 1 9 0 4 Imperial. 7 1 02 5 3 4 6 Cu. inch. 6 7 8 9 1 3 9 8 9 5 2 Fluid ounce |3 7 Ð 6 7 7 2 8 1 7 4 4 5 Imperial. 8 G 3 8 4 4 9 4 8 Gill. 2 I Ţ 0 7 4 3 9 3 6 Imperial. Ţ Ŧ ₽ I 2 1 1 2 4 3 7 Pint. 7 Ţ 3 ť Ţ 2 Þ 8 5 9 2 6 1 1 Dry 9 6 2 g 8 Ð g 7 6 0 9 8 11 Ţ 9 \mathbf{e} 9 g Imperial. 1 05 6 7 1 8 Quart. g 8 7 ₽ 6 1 | 9 0 7 9 6 8 Dry. 8 7 Į. 8 Ţ 8 8 0 4 9 2 Imperial. 3 g 0 2 6 Ţ Ţ 2 6 4 1 8 0 Gallon. 6 0 0 I 3 5 6 1 7 9 8 2 2 0 1 2 6 Imperial. 8 Ġ G 1 1 1 8 1 3 2 0 9 0 Peck. Ţ 2 7 7 8 8 7 5 3 \$ \$ 0 \$ 7 т 6 Cubic foot. 2 8 3 7 4 Bushel. 7 9 6 0 6 0 I 9 E 12 7 5 1 6 Imperial. Đ 8 3 3 6 2 1 5 0 8 1 6 7 8 2 1 9 2 1 3 2 9 Cubic yard.

TERMS USED IN DESCRIPTIONS.

Many of the terms used in describing the parts of insects are derived from the latin and have not come into common use in general literature. The following are among those most used:

Shape. —Arcuate, curved. Attenuate, much narrowed. Clavate, clubshaped. Cordate, heart-shaped. Cuneate, wedge-shaped. Emarginate, edge with a large blunt incision. Falcate sickle-shaped. Incrassate, swollen. Lanceolate, lance-shaped. Lobate, with rounded portions produced by deep imcisions. Lunate, moon-schaped. Mucronate, ending abruptly in a sharp point. Quadrate, square. Reniform, kidney-shaped. Rotundate, round. Sinuate, edge strongly wavy. Spatulate, spatula-shaped. Subulate, awl-shaped. Tri-

quetral, three-sided. Truncate, appearing as if cut off. Tumid, swollen.

Surface.— Canaliculate, with a broad central furrow. Ciliate, fringed with hairs. Coreaceous, leathery. Corneous, horny. Fasciculate, with bundles of long hair. Glabrous, smooth, free from hairs. Muricate, covered with small sharp-pointed elevations. Pilose, with abundant rather short erect hair. Porcate, with very broad and deep grooves. Pubescent, with very fine hairs. Rugose, with wrinkles. Scabrous, covered with broad flat scales. Striate, with fine parallel impressions. Sulcate, with rather large grooves. Tesselate, checkered. Tomentose, with long tangled hairs. Ventricose, greatly swollen. Verrucose, warty. Villose, with long erect hairs.

Colors.—Æneus, bronze colored. Brunneus, a pure bright brown. Castaneus, chestnut-brown. Cinereus, dark gray. Cupreus, copper colored. Ferrens, iron gray. Ferrugineus, rust red. Fuliginus, soot brown. Fulvus, light brown. Fuscus, dull dark brown. Glaucus, a bright blue inclined to gray. Livid, a pale yellow. Lurid, a dirty yellow inclining to brown. Luteus, clay yellow. Piceus, pitchy black. Pruinose, covered with a whitish bloom. Sanguineus, blood red. Testaceus, dull yellowish brown.

FOUR PLACE LOGARITHM TABLE.

The following table of logarithms is designed for rapid percentage determinations. Relative abundance of insects should be given in per cents. The use of such tables is so well understood that no explanations will be necessary.

This table of logarithms differs from others as follows:— 1st. The use of antilogarithms avoids the inaccuracy of the zero end of the table. 2nd. tions. 3rd. The arrangement in columns, the spacing, and the position of the difference columns, are calculated to lessen the danger of error in reading. The use of five digits avoids inaccuracy in the fourth place in interpolated to contribute to rapidity of work.

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36 176	35 888	35 588	34 277	34 956 3	33 624	33 282	32 930	32 569	31 198	
217	958	657	346	023	690	347	995	632	261	
3 19	029	727	414	090	757	413	059	696	323	
. 390	099	796	482	158	823	478	123	759	386	
462	169	865	5 50	224	889	543	187	822	448	
7 84510	85126	85733	86332	86923	87506	88081	88649	89209	89763	7
6 572	6 187	8 794	6 392	6 982	6 564	6 138	6 705	7 265	5 818	4
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22 526	21 062	21 593	21 117	21 634 2	20 146	20 651	20 151	20 645	19 134	
27 580	27 116	26 645	26 169	26 686 2	25 197	25 702	25 2 01 :	25 694	24 182	
634	169	698	221	737	247	752	250	743	2 31	
687	2 22	751	273	788	298	802	300	792	279	
741	2 75	803	324	840	349	852	349	841	328	
795	328	855	376	891	399	902	399	890	376	
9 95424	95904	96379	96848		97772	98227	98677	99123	99563	9
5 472	5 952	5 426	5 895		5 818	5 272	4 722	4 167	4 607	-
10 521	10 999	9 473	9 942		9 864	9 318	9 767	9 211	9 651	
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24 665		24 614	400 400	589	046	498	945	388	826	
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761	237	708	174						913	
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ANTI-LOGARITHMS.

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139	375	617	864	117	376		912	190		
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209	447	691	940	194	455	722	995	274	560	
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6 647	6 942	6243	6 552	6 868	7 191	7 - 521	7859	7 - 205	7 560	
9 677	9 972	9 274	9 583		10 223		10 894	11 241	11 596	
12 706	12 002	$12 \ 305$	13 614	13 932	13 256	13 588	14 928	16 276	19 631	
15 735	15 032	15 335	16 646		16 289		17 962	18 311	18 688	
764	062	366	677	996	322	655	997	346	704	
794	092	397	709	028	355	689	031	382	740	
823	122	428	740	060	388	723	066	417	776	
853	152	459		093	421	757	101	453	812	
2 15849	16218	16596	16982	17378	17783	18197	18621	19055	19498	9
4 885	4 255	4 634	4 022	4 418	4 824	4 239	4 664	4 099	5 543	4
7 922	8 293	8 672	8 061	8 458	8 865	8 281	9 707	9 143	9 588	
11 922		12 711			12 906		13 750			
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069	444	827	2 19	620	030	450	880	320	770	
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144	520	904	298	701	113	535	967	409	861	
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3 19953	20417	20893	21380	21878	22387	22909	23442	23988	24547	3
5999	5 464	5941	5429	5928	5 439	5962	$5\ 496$	6 044	6 604	
9 045		10 989		10 979	$10 \ 491$	TT OIL	11 000	11 000		
14 0 91	14 559	15 0 38	15 528			16 0 67				
19 137	19 606	19 0 86	20 577	20 080						
23 184	24 654	24 135		25 131	26 646	27 174	27 714		28 831	
230	701	184	677	182	699	2 27	768	322	889	
277	749	232	727	2 33	751	2 31	823	378	946	
324	797	281	777	2 84	803	3 35	878	434	003	
370	845	330	827	3 36	856	3 88	933	491	061	
4 25119	25704	26303	26915	27542	28184	28840	933 29512	30200	30903	4
6 177	6 763	6 363	6 977	6 606	7 249	7 907	7 580	7 269	7 974	
12 235	12 823		13 040	13 659	13 314	13 973	14 648			
18 293		18 485		19 733	20 379	20 040	21 717			
23 351	24 949	24 546	25 164	26 797	27 445	27 107	28 785			
29 410	20 002	31 607				34 174	34 854			
	062	669	290	925	576	242	923	620	333	
$\frac{468}{527}$	122			990	642	309	992	690	405	
	182	709	A16	054	708	377	061	761	477	
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645	242	853	419	119	5	6	7	8	9	
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7 696	8 434	8 189	8 963	8 754	8 563	8 392	9 239	9 107	9 994
15769	15 509	15 266	16.041	16 834	17 645	17 475	17 325	18 194	18 084
23 842	23 584	23 343	24 119	24 914	25 727	25 559	26 411	27 282	27 174
29 915	30 659	31 420	32 198.	32 995	33 810	34 644	35 497	35 371	36 2 64
38 989	38 734	39 497	40 277	40 075	41 892	42 728	43 584	49 459	45 355
0 63	. 810	574	3 56	156	975	813	670	584	446
137	885	651	435	237	058	898	757	637	537
$rac{1}{1}$. 961	729	514	3 18	141	983	844	726	628
2 85	. 037	806	5 94	400	2 24	068	932	815	719
6 39811	40738	41687	42658	4	5	6	7	8	9
9 902			10 756						
19 994	19 926	19 879	20 855						
28 0 87	28 0 20		30 954						
37 179	38 115	39 0 73	40 0 53						
46 272	47 210	49 170	50 152						
365	305	267	2 51					•	
458	400	364	351						
551	495	462	451						
644	~ 591	560	5 51						
0	1	2	3						

A plan for indexing notes or books is given below. A few examples will render the use of these tables clear. This book would be indicated by In—choCal which would mean a catalogue with synopses and helps for the study of the insects of California.. A textbook on zoology would be marked z—h, A list of the sphingidæ of the United States is indicated by InSp—cU

PRIMARY DIVISIONS. (One or two letter the initial a capital.)

Art. 2. Accounts. Administration. Agriculture. Algebra. Amusements, Anthropology. Architecture. Astronomy.

Biography. 2. Banking. Beverages. Biology. Bleaching. Botany. Building.

Chemistry. 2. Calculus. Ceramics. Church. Commerce. Customs.

Domestic economy. 2. Dentistry. Dichotyledons. Drawing. Dyeing Engineering. 2 Ecology. Education: Electricity. Embryology. Engraving. Ephemerides. Eschatology. Ethics. Evolution:

Fiction. 2 Factories. Finance. Forestry.

Government. 2. Geology.

History. 2. Heat. Horticulture. Humor. Hymnology.

Industries. 2. Immigration. Insects. Irrigation.

Juvenile. 2. Jurisprudence.

Kinematics.

Literature. 2. Landscape gardening. Library science. Logic.

Medicine. 2. Mathematics. Mechanics. Mining. Morphology. Music,

Nature. 2. Numbers.

Occultism. 2. Obstetrics, Oils. Optics. Orchestra.

Physics. 2. Painting. Petrography. Philosophy. Piano. Plumbing Politics. Printing. Psychology. Pyrotecnics.

Religion. 2. Roofing.

Sociology. 2. Sacraments. Sculpture. Ship building. Slavery. Socialism. Specifications. Statistics. Sujrage. Synthesis.

Technology. 2. Taxes. Temperance. Theology. Transportation.

War. 2. Women.

Xylography.

Yachting.

Zoology. 2. Zootechny.

FORM DIVISIONS. (small letter following —.)

addresses. (lectures, essays, papers, tracts, letters, etc.)

bibliography.

catalogs.

dictionaries. (lexicons.)

encyclopedias. (collected works.)

figures. (illustrations.)

helps (study, schools, etc.)

indexes. (concordances.)

journals. (magazines, newspapers, reviews, periodicals etc.)

libraries.

museums. (exhibitions.)

note. (brief mention.)

outlines. (compends, tabular view, synopses, charts, etc.)

philosophy. (theory.)

questions. (catechisms.)

reports (of institutions or associations.)

statistics.

utility. (economics.)

GEOGRAPHICAL DIVISIONS. (Following form abbreviations.)

- Asia. 2 Abyssinia. Africa. Alaska. Anhalt. Argentina. Assiniboia. Athabasca. Austria-Hungary. Azores. 3 Afghanistan. Alabama. Alberta. Algeria. Alsace-Lorraine. Andorra. Antarctic region. Arctic region. Arabia. Arizona. Arkansas. Australia. 4. Austria.(kingdom.)
- Brazil. 2. Baluchistan. Bc. (British Columbia.) Belgium. Bolivia. British
 East Africa. Burma. 3. Baden. Bavaria. Bermudas. Bohemia. Borneo.
 Bosnia. Bremen. British South Africa. Brunswick. Bukowina. Bulgaria.
 4. British Honduras.
- China. 2. Canada. Central America. Chile. Columbia. Croatia and Slavonia. Cuba. Cv. (Cape Verde Islands.)
 Cape Colony. Carinthia. Celebes Islands. Ceylon. Coastland. Colorado. Connecticut. Corsica. Costa Rica. Crete.
 4. Carniola.

Denmark. 2. Dalmatia. Delaware. District of Columbia.

Europe. 2. Ecuador, Egypt. England.

- France. 2. Falkland Islands. Fiji Islands. Florida. French Indo-China. 3. Fiume.
- Germany. 2. Galicia. German East Africa. Great Britain. Guatamala. 3. Georgia. German South West Africa. Greece. Gub. (Guiana, British.) Gud. (Guiana, Dutch.) Guf. (Guiana, French.) 4. Greenland.
- Hungary. 2. Haiti. Herzegovinia. Honduras. 3. Hamburg. Hawaiian Islands. Hesse.
- India. 2. Iceland. Idaho. Illinois. Indiana. Iowa, Ireland, Italy,
- Japan. 2. Java. 3. Jamaica.
- Kongo Free State. 2. Kamerun. Keewatin. Kongo (French.) 3. Kansas. Kentucky. Korea.
- Liberia. 2. Lippe. Lower Austria. Luxemburg. 3. Lichtenstein. Louisiana. Lubek.
- Mexico 2. Madagascar. Me. (Maine.) Michigan. Mn. (Mecklenburg Schwerin.) Mo. (Missouri.) Mz. (Mecklenburg Stralitz.) 3.Mackenzie Madeira Islands. Manitoba. Maryland. Massachusetts. Minnesota. Missisippi. Montana. Morocco. 4. Montenegro. Moravia.
- North America. 2. Natal. Nb. (New Brunswick.) Nc. (North Carolina.) Nd. (North Dakota.) Netherlands. Nf. (New Foundland.) Ng. (New Guinea.) Nh. (New Hampshire.) Nicaragua. Nj. (New Jersey.) Nm. (New Mexico.) Norway. Ns. (New South Wales.) Ny. (New York.) Nz. (New Zealand.) 3. Nebraska. Nevada. Nova Scotia. 4. Novibazar.
- Oceanica. 2. Obok. Obio. Oklahoma Oldenburg. Oman. Ontario Oregon. 3. Orange Free State.
- Persia. 2. Paraguay. Peru. Philippines. Portugal. Prussia, 3, Panama. Pennsylvania. Poe. (Portuguese East Africa.) Pog. (Portuguese Guinea.) Poland. Porto Rico. Pow. (Portuguese West Africa.)
- Queensland. 2. Quebec.
- Russia. 2. Reuss Gera Schleiz. Rhodesia. Roumania. 3. Reuss Griez. Rumelia.
- South America. 2. Saskatchewan. Sc. (South Carolina.) Cd. (South Dakota.) Servia. Siberia. South Australia. Spain. Styria. Sumatra. Sweden. 3. Salvador. Samoa. Santo Domingo. Sardinia Saxony. Scotland. Siam. Sicily. Sierra Leone. Somali Coast. Straits Settlement. Switzerland. 4. Salzburg. Smaos. San Marino. Saxa. (Saxe Altenburg.) Saxc. (Saxe Coburg.) Saxm. (Saxe Meiningen.) Saxw. (Saxe Weimar Eisenach.) Schl. (Schaumburg Lippe.) Schr. Schwartzburg Rudolphstat.) Schs. (Schwartzburg Sandershausen.)
- Turkey. 2. Tasmania. Texas. Tripoli. Tunis. Tyrol. 3. Tennessee Transvaal.
- United States. 2. Ungava. Upper Austria. Uraguay. Utah.
- Venezuela. 2. va. (Virginia.) Vermont. Victoria. Vorarlberg.
- West Australia. 2. Wales. West Virginia. Wisconsin. Wuertemberg. Wyoming. 3. Waldeck. Washington.
- Yucon. 2. Yellowstone Park. Yosemite Park.

SUBDIVISIONS OF INSECTS.

Aptera. 2. Acrididæ. Æschnidæ. Agapetidæ. Aleurodidæ. Amphizoidæ. Anthophoridæ. Apidæ. Arctiidæ. Asilidæ. Atropidæ. 3. Ægialyt-

- idæ. Æolothripidæ. Agaristidæ. Agromyzidæ. Alysiidæ, Andrenidæ,Anisotomidæ, Anobiidæ, Anthicidæ, Aphidæ, Apioceridæ, Aradidæ. 4. Agaonidæ, Agrionidæ, Anthomyidæ, 5. Anthribidæ, Anthocoridæ.
- Bombylidæ. 2. Belostomidæ, Bibionidæ, Blastobasidæ, Bombidæ, Brachonidæ, Buprestidæ, Byrrhidæ. 3. Bembecidæ, Berytidæ, Blattidæ, Blepharoceridæ, Bombycidæ, Borboridæ, Bostrychidæ, Bruchidæ, Byturidæ.
- Coleoptera. 2. Carabidæ, Cerambycidæ, Chrysomelidæ, Cicindelidæ, Cleridæ, Corrodentia, Crabronidæ, Culicidæ, Cynipidæ. 3. Calandridæ, Calandridæ, Campodidæ, Capsidæ, Cecidomyidæ, Cephidæ, Ceratinidæ, Chironomidæ, Chrysididæ, Cicadidæ, Cimbycidæ, Cistelidæ, Clambidæ, Cleonidæ, Cocendæ, Colletidæ, Conopidæ, CoreidæCossidæ, Cryptophagidæ, Cucujidæ, Cupesidæ, Curculionidæ Cydnidæ, Cyrtidæ. Calamoceratidæ, Calopterygidæ, Cercopidæ, Ceroptridæ, Chrysididæ, Cimicidæ, Cisidæ, Clavigeridæ, Coccinellidæ Colydiidæ, Coniopterygidæ, Corimelænidæ, Corylophidæ, Cordulidæ. 5. Cerophytidæ, Corisidæ, Cordulegasteridæ.
- Diptera. 2. Dascyllidæ, Dermestidæ. Dioptidæ, Dolichopidæ, Drosophilidæ, Dytiseidæ. 3. Dexiidæ, Dolcridæ.
- Ephemerida. 2. Elateridæ, Empidæ, Endomychidæ, Ephydridæ, Erotylidæ, Eumenidæ, Evaniidæ. 3. Elachistidæ, Embiidæ, Encyrtidæ, Eucharidæ, Eulophidæ, Eurytomidæ. 3. Eucnemidæ.
- Formicidæ. 2. Figitidæ, Forficulidæ, Fulgoridæ.
- Geometridæ. 2. Galgulidæ, Gelechiidæ, Gomphidæ, Gryllidæ, Gyrinidæ. 3. Geomyzidæ, Gerridæ, Gyropidæ. 4. Georyssidæ.
- Hymenoptera. 2. Haliplidæ, Hemiptera, Histeridæ, Hydrophilidæ. 3. Helomyzidæ, Henicocephalidæ, Hepialidæ, Hesperidæ, Heteroceridæ, Hippoboscidæ, Hydroscaphidæ, Hylatomidæ, Hyponomeutidæ. 4. Helodidæ, Hemerobiidæ, Hydropsychidæ.
- Ichneumonidæ. 2. Ipidæ, Ithomiidæ.
- Jassidæ. 2. Japygidæ.
- Lepidoptera. 2. Lathrididæ, Leptidæ, Libellulidæ, Locustidæ, Lycænidæ. 3. Lagriidæ, Lariidæ, Lasiocampidæ, Lecanidæ, Lepismidæ, Limnephilidæ, Liotheidæ, Liparidæ, Lithosiidæ, Lonchopteridæ, Lophyridæ, Lyctidæ, Lygæidæ Lymnadidæ. 4. Larridæ, Lipuridæ.
- Mutillidæ. 2. Malachidæ. Meloidæ, Miscogasteridæ, Mordellidæ, Muscidæ, Myrmeleonidæ. 3. Machilidæ, Marsaridæ, Mantidæ, Megachilidæ, Melandryidæ, Membracidæ, Micropterygidæ, Monotomidæ, Mycetophagidæ, Mydaidæ, Mymaridæ, Myzinidæ. 4. Mantispidæ, Micropezidæ, Monommidæ, Mycetophilidæ.
- Ncuroptera. 2. Naucoridæ, Nematidæ, Nitidulidæ, Noctuidæ, Nymphalidæ. 3. Nabidæ, Nepidæ, Nolidæ, Nomadidæ, Notodontidæ, Nycteolidæ, Nyssonidæ. 4. Notonectidæ.
- Orthoptera. 2. Odonata, Œcophoridæ, Ortalidæ, Oscinidæ, Otiorhynchidæ, Oxybelidæ. 3. Odontoceridæ, Œdemeridæ, Œstridæ, Orneodidæ, Oryssidæ, Ostomidæ, Othniidæ.
- Pyralidæ. 2. Papilionidæ, Pentatomidæ, Philopteridæ, Pieridæ, Platypterygidæ, Proctotrypidæ, Pselaphidæ, Ptinidæ, Pulicidæ, Pyralidæ. 3. Pam-Philiidæ, Panurgidæ, Parnasiidæ, Pediculidæ, Pelicinidæ, Pemphredonidæ, Pericopidæ, Platypezidæ, Philanthidæ, Phlæothripidæ, Phoridæ, Pipunculidæ, Prosopidæ, Psamocharidæ, Psocidæ, Psychodidæ, Pterophoridæ, Ptilidæ, Pyrrhocoridæ, Pythidæ. 4. PanorpidæParnidæ, Perlidæ, Phasmidæ,

Phalacridæ, Psoidæ, Psychomyidæ, Pteromalidæ, Pteromalidæ, Pyrochroidæ. 5. Psychidæ.

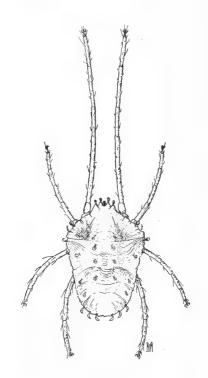
Reduviidæ. 2. Raphidiidæ, Rhynchidæ. Riordinidæ. 3, Rhinomaceridæ, Rhyacophilidæ. 4. Rhipiphoridæ,Rhysodidæ. 5. Rhipiceridæ,

Staphylinidæ. 2. Saturniidæ, Scarabæidæ, Sessiidæ, Simuliidæ, Smynthuridæ, Sphingidæ, Strttiomyidæ, Syrphidæ. 3. Saldidæ, Eapromyzidæ, Sarcophagidæ, Scatophagidæ, Scenopidæ, Sciomyzidæ, Scoliidæ, Scutelleridæ, Scydmænidæ, Selandriidæ, Sepsidæ, Sercostomatidæ SialidæSiricidæ, Sphegidæ, Spondylidæ, Stephanidæ, Stizidæ, Stylopidæ, Syntomidæ. 4. Sapygidæ, Sarcopsyllidæ, Scaphidiidæ, Sphæridæ, Sphindidæ.

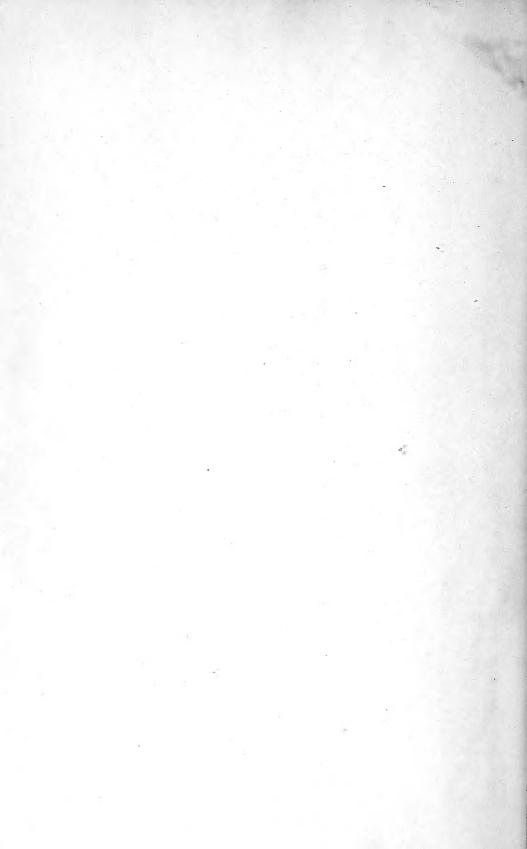
Tenebrionidæ. 2. Tachinidæ, Tenthredinidæ, Thripidæ, Tineidæ, Tortricidæ, Trypetidæ. 3. Tabanidæ, Tenipedidæ, Termitidæ, Tendipedidæ, Termitidæ, Therevidæ, Thinnidæ, Throscidæ, Thyatiridæ, Tipulidæ, TingidæTorymidæ, Trichopterygidæ, Thyatiridæ, Trypoxylidæ, 4. Thyridæ, Tiphiidæ, Thyridæ, Tiphiidæ, Trichodectidæ.

Vespidæ. 2.Veliidæ,

Xylocopidæ. 2. Xylorictidæ,







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AUTHOR

Woodworth, Charles William

TITLE

Guide to California insects



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